

Rexroth PLC Modules MTS-P01.2/G2 and MTS-P02.2/G2

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Project Planning Manual



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1 Rexroth PLC MTS-P01.2 and MTS-P02.2

1.1 Brief Description

The MTS-P01.2 and MTS-P02.2 PLC assemblies are efficient PLC controls in ISA-bus plug-in card format, intended for being fitted in a BTV20/30 or in a commercially available industrial PC. The MTS-P02.2 is equipped with a hardware which, contrary to the MTS-P01.2, shows a performance increased by a factor of 2 to 2.5 (depending on the program structure).

An MTS-P consists of a basic unit with ISA-BUS (the actual PLC) and an active PC/104 interface as well as various PC/104 plug-on modules, such as fieldbus connections, serial interfaces, and I/O modules. The serial COM user interface (RS232), which is operated via the PLC user program, is provided for connection of a printer, a read-write memory, or an operating and visualization device, e.g. Rexroth BTV04/05. Multimode operation of the interface (RS232/RS422/RS485) is configured using an PLC function block.

In addition, the MTS-P01.2 and the MTS-P02.2 are provided with a BT (**B**edien**T**erminal = operator terminal) bus, which can be used to operate up to 4 operator terminals (BTM15/16, BTA20, etc.). This can be achieved using cable lengths of up to 50 m (between the INTERBUS connection and the last user).

The MTS-P0*.2 is provided with 16 TTL inputs and 16 TTL outputs. These can, for instance, be used to directly connect the machine function keys and key switches of the BTV20.

The MTS-P assembly can be operated as a stand alone PLC or, in connection with an MTC-P, as a slave PLC. The firmware of the PLC, which is stored in a Flash EPROM, serves to distinguish between master and slave operation.

Communication with decentralized I/O units or operating units is established by means of fieldbus connections (which can be plugged on as an option) and/or serial interfaces. These optional connections and interfaces are designed as PC/104 modules. At present, the following connections and interfaces are available:

- INTERBUS master connection
- PROFIBUS master connection
- PROFIBUS slave connection
- DeviceNet master connection
- Serial interfaces (2 x RS232 and 2 x RS422/485)

Up to 4 PC/104 modules can be operated on an MTS-P01.2 or MTS-P02.2.

1.2 Side and Front View of the MTS-P01.2 and MTS-P02.2

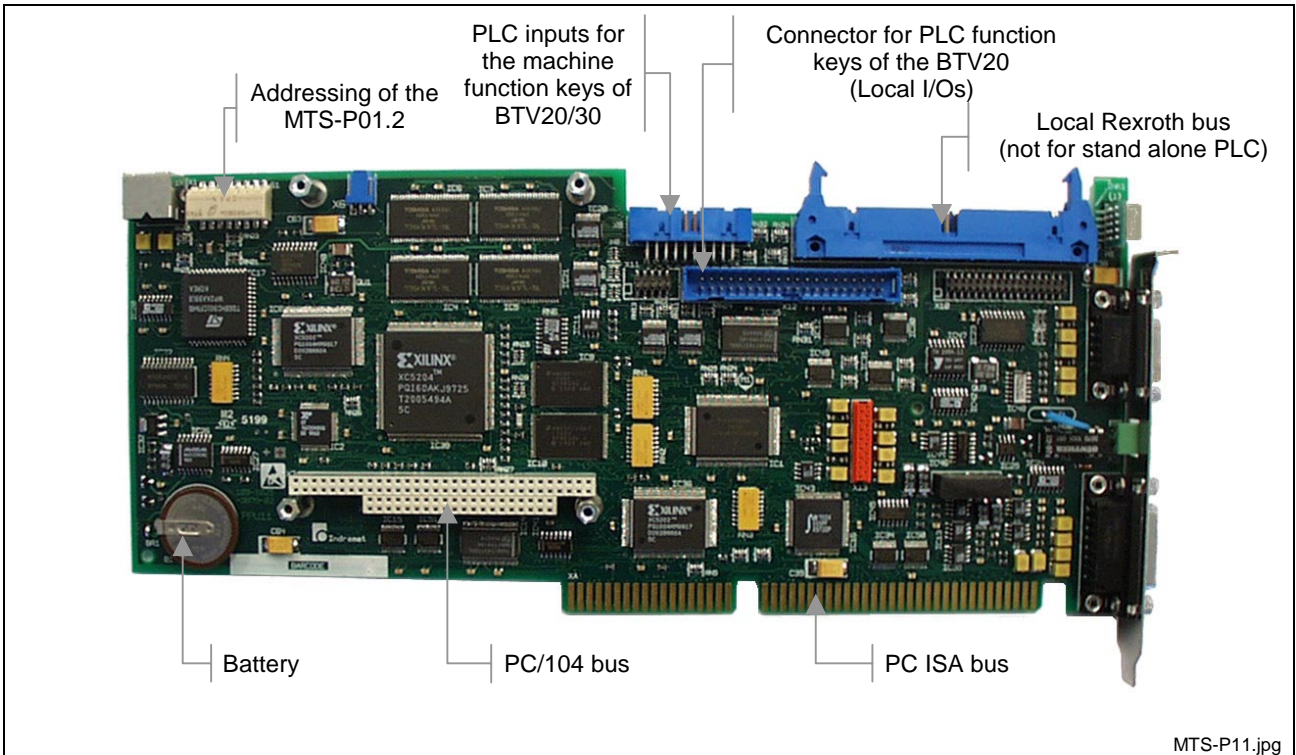


Fig. 1-1: MTS-P01.2

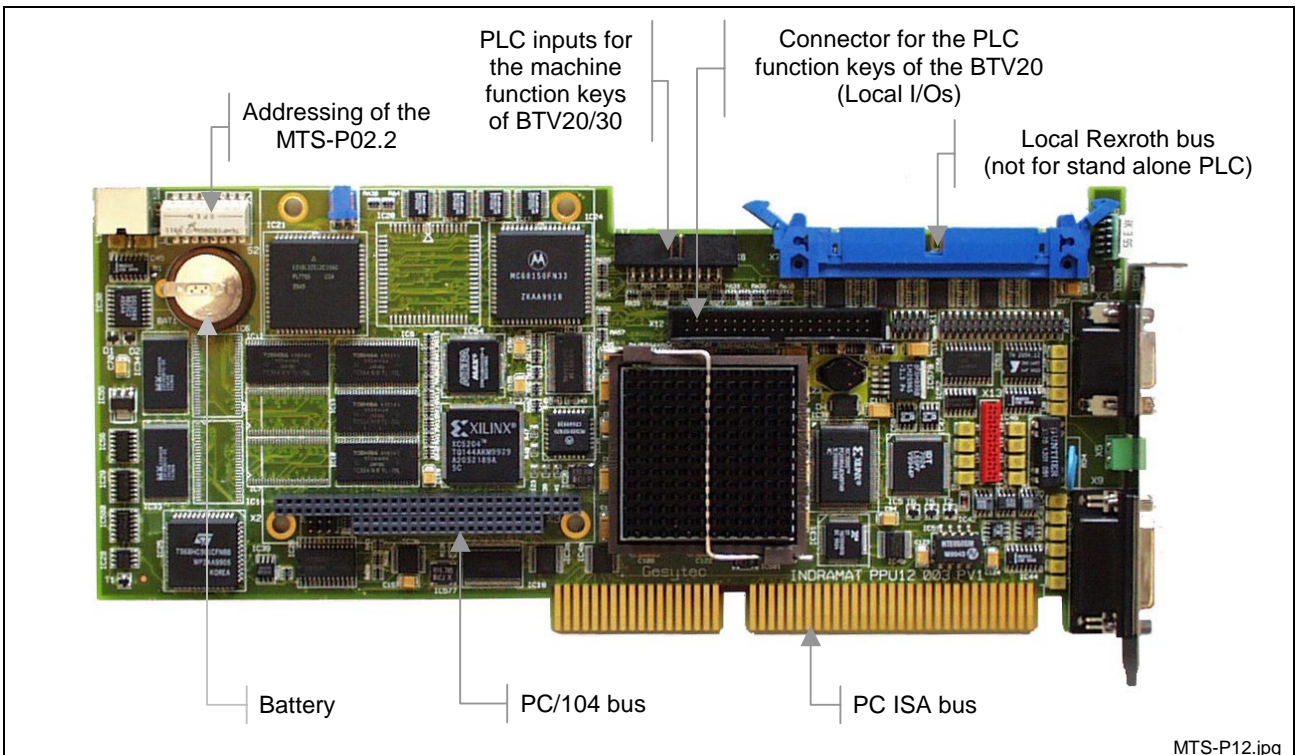


Fig. 1-2: MTS-P02.2

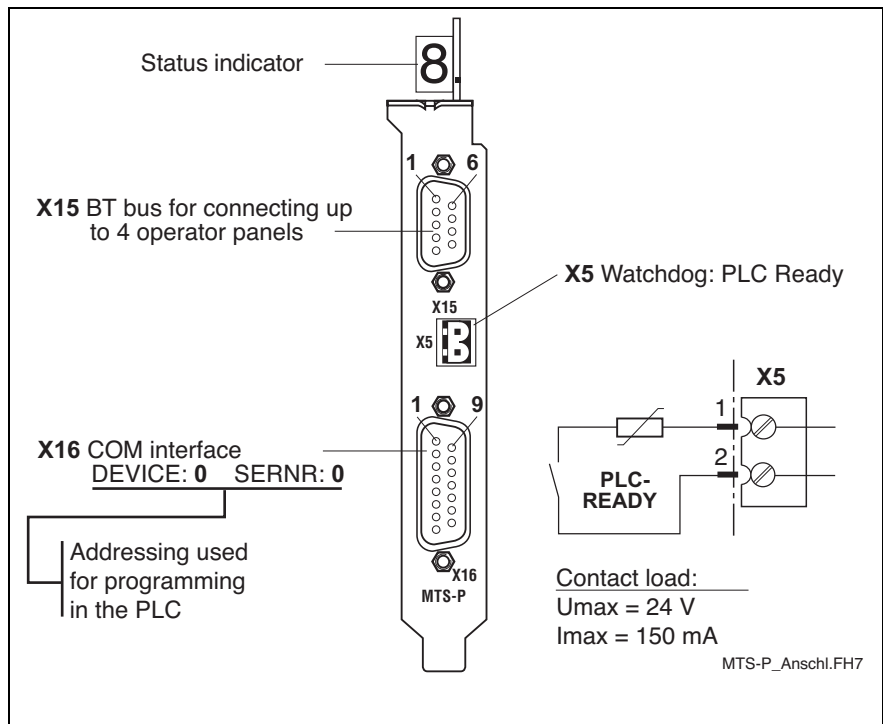


Fig. 1-3: Front view of MTS-P01.2/G2 and MTS-P02.2/G2

2 Important Directions for Use

2.1 Appropriate Use

Introduction

Bosch Rexroth products represent state-of-the-art developments and manufacturing. They are tested prior to delivery to ensure operating safety and reliability.

The products may only be used in the manner that is defined as appropriate. If they are used in an inappropriate manner, then situations can develop that may lead to property damage or injury to personnel.

Note: Bosch Rexroth, as manufacturer, is not liable for any damages resulting from inappropriate use. In such cases, the guarantee and the right to payment of damages resulting from inappropriate use are forfeited. The user alone carries all responsibility of the risks.

Before using Bosch Rexroth products, make sure that all the prerequisites for appropriate use of the products are satisfied:

- Personnel that in any way, shape or form uses our products must first read and understand the relevant safety instructions and be familiar with appropriate use.
- If the product takes the form of hardware, then they must remain in their original state, in other words, no structural changes are permitted. It is not permitted to decompile software products or alter source codes.
- Do not mount damaged or faulty products or use them in operation.
- Make sure that the products have been installed in the manner described in the relevant documentation.

Areas of Use and Application

The MTS-P01.2 and MTS-P02.2 of Bosch Rexroth are intended to be installed in an industrial PC, preferably a BTV20/30 of Bosch Rexroth, with ISA bus. Designed as "Plug-in PLC" the MTS-P is intended for the following fields of application:

- Stand alone PLC
- Matching control for MTC200
- Matching control for MTA200

Note: The MTS-P may only be used with the accessories and parts specified in this document. If a component has not been specifically named, then it may not be either mounted or connected. The same applies to cables and lines.

Operation is only permitted in the specified configurations and combinations of components using the software and firmware as specified in the relevant function descriptions.

Before being commissioned each MTS-P has to be programmed, so that the PLC executes the application-specific functions.

The MTS-P01.2 and MTS-P02.2 were especially developed for the use in industrial PCs as for example for the BTV20 and BTV30.

For the application-specific use of the MTS-P configuration with different fieldbuses and serial interfaces are available.

Typical areas of application of the MTS-P01.2 and MTS-P02.2 are:

- Handling and mounting systems
- Packaging and food machines
- Printer and paper processing machines
- Machine tools

The MTS-P may only be operated under the assembly, installation and ambient conditions as described here (temperature, system of protection, humidity, EMC requirements, etc.) and in the position specified.

2.2 Inappropriate Use

Using the MTS-P01.2 and MTS-P02.2 outside of the above-referenced areas of application or under operating conditions other than described in the documentation and the technical data specified is defined as "inappropriate use".

The MTS-P may not be used, if

- it is subject to operating conditions that do not meet the above specified ambient conditions. This includes, for example, operation under water, in the case of extreme temperature fluctuations or extreme maximum temperatures

or if

- Bosch Rexroth has not specifically released them for that intended purpose. Please note the specifications outlined in the general Safety Instructions!

3 Safety Instructions for Electric Drives and Controls

3.1 Introduction

Read these instructions before the initial startup of the equipment in order to eliminate the risk of bodily harm or material damage. Follow these safety instructions at all times.

Do not attempt to install or start up this equipment without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation of the equipment prior to working with the equipment at any time. If you do not have the user documentation for your equipment, contact your local Bosch Rexroth representative to send this documentation immediately to the person or persons responsible for the safe operation of this equipment.

If the equipment is resold, rented or transferred or passed on to others, then these safety instructions must be delivered with the equipment.



Improper use of this equipment, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, may result in material damage, bodily harm, electric shock or even death!

3.2 Explanations

The safety instructions describe the following degrees of hazard seriousness in compliance with ANSI Z535. The degree of hazard seriousness informs about the consequences resulting from non-compliance with the safety instructions.

Warning symbol with signal word	Degree of hazard seriousness according to ANSI
	Death or severe bodily harm will occur.
	Death or severe bodily harm may occur.
	Bodily harm or material damage may occur.

Fig. 3-1: Hazard classification (according to ANSI Z535)

3.3 Hazards by Improper Use



DANGER

**High voltage and high discharge current!
Danger to life or severe bodily harm by electric shock!**



DANGER

Dangerous movements! Danger to life, severe bodily harm or material damage by unintentional motor movements!



WARNING

High electrical voltage due to wrong connections! Danger to life or bodily harm by electric shock!



WARNING

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!



CAUTION

Surface of machine housing could be extremely hot! Danger of injury! Danger of burns!



CAUTION

Risk of injury due to improper handling! Bodily harm caused by crushing, shearing, cutting and mechanical shock or incorrect handling of pressurized systems!



CAUTION

Risk of injury due to incorrect handling of batteries!

3.4 General Information

- The Bosch Rexroth AG is not liable for damages resulting from failure to observe the warnings provided in this documentation.
- Read the operating, maintenance and safety instructions in your language before starting up the machine. If you find that you cannot completely understand the documentation for your product, please ask your supplier to clarify.
- Proper and correct transport, storage, assembly and installation as well as care in operation and maintenance are prerequisites for optimal and safe operation of this equipment.
- Only persons who are trained and qualified for the use and operation of the equipment may work on this equipment or within its proximity.
 - The persons are qualified if they have sufficient knowledge of the assembly, installation and operation of the equipment as well as an understanding of all warnings and precautionary measures noted in these instructions.
 - Furthermore, they must be trained, instructed and qualified to switch electrical circuits and equipment on and off in accordance with technical safety regulations, to ground them and to mark them according to the requirements of safe work practices. They must have adequate safety equipment and be trained in first aid.
- Only use spare parts and accessories approved by the manufacturer.
- Follow all safety regulations and requirements for the specific application as practiced in the country of use.
- The equipment is designed for installation in industrial machinery.
- The ambient conditions given in the product documentation must be observed.
- Use only safety features and applications that are clearly and explicitly approved in the Project Planning Manual.

For example, the following areas of use are not permitted: construction cranes, elevators used for people or freight, devices and vehicles to transport people, medical applications, refinery plants, transport of hazardous goods, nuclear applications, applications sensitive to high frequency, mining, food processing, control of protection equipment (also in a machine).
- The information given in the documentation of the product with regard to the use of the delivered components contains only examples of applications and suggestions.

The machine and installation manufacturer must

 - make sure that the delivered components are suited for his individual application and check the information given in this documentation with regard to the use of the components,
 - make sure that his application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.
- Startup of the delivered components is only permitted once it is sure that the machine or installation in which they are installed complies with the national regulations, safety specifications and standards of the application.
- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

- Operation is only permitted if the national EMC regulations for the application are met.
The instructions for installation in accordance with EMC requirements can be found in the documentation "EMC in Drive and Control Systems".
The machine or installation manufacturer is responsible for compliance with the limiting values as prescribed in the national regulations.

3.5 Protection Against Contact with Electrical Parts

Note: This section refers to equipment and drive components with voltages above 50 Volts.

Touching live parts with voltages of 50 Volts and more with bare hands or conductive tools or touching ungrounded housings can be dangerous and cause electric shock. In order to operate electrical equipment, certain parts must unavoidably have dangerous voltages applied to them.



DANGER

High electrical voltage! Danger to life, severe bodily harm by electric shock!

- ⇒ Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain or repair this equipment.
 - ⇒ Follow general construction and safety regulations when working on high voltage installations.
 - ⇒ Before switching on power the ground wire must be permanently connected to all electrical units according to the connection diagram.
 - ⇒ Do not operate electrical equipment at any time, even for brief measurements or tests, if the ground wire is not permanently connected to the points of the components provided for this purpose.
 - ⇒ Before working with electrical parts with voltage higher than 50 V, the equipment must be disconnected from the mains voltage or power supply. Make sure the equipment cannot be switched on again unintended.
 - ⇒ The following should be observed with electrical drive and filter components:
 - ⇒ Wait five (5) minutes after switching off power to allow capacitors to discharge before beginning to work. Measure the voltage on the capacitors before beginning to work to make sure that the equipment is safe to touch.
 - ⇒ Never touch the electrical connection points of a component while power is turned on.
 - ⇒ Install the covers and guards provided with the equipment properly before switching the equipment on. Prevent contact with live parts at any time.
 - ⇒ A residual-current-operated protective device (RCD) must not be used on electric drives! Indirect contact must be prevented by other means, for example, by an overcurrent protective device.
 - ⇒ Electrical components with exposed live parts and uncovered high voltage terminals must be installed in a protective housing, for example, in a control cabinet.
-

To be observed with electrical drive and filter components:



DANGER

**High electrical voltage on the housing!
High leakage current! Danger to life, danger of
injury by electric shock!**

- ⇒ Connect the electrical equipment, the housings of all electrical units and motors permanently with the safety conductor at the ground points before power is switched on. Look at the connection diagram. This is even necessary for brief tests.
- ⇒ Connect the safety conductor of the electrical equipment always permanently and firmly to the supply mains. Leakage current exceeds 3.5 mA in normal operation.
- ⇒ Use a copper conductor with at least 10 mm² cross section over its entire course for this safety conductor connection!
- ⇒ Prior to startups, even for brief tests, always connect the protective conductor or connect with ground wire. Otherwise, high voltages can occur on the housing that lead to electric shock.

3.6 Protection Against Electric Shock by Protective Low Voltage (PELV)

All connections and terminals with voltages between 0 and 50 Volts on Rexroth products are protective low voltages designed in accordance with international standards on electrical safety.



WARNING

**High electrical voltage due to wrong
connections! Danger to life, bodily harm by
electric shock!**

- ⇒ Only connect equipment, electrical components and cables of the protective low voltage type (PELV = Protective Extra Low Voltage) to all terminals and clamps with voltages of 0 to 50 Volts.
- ⇒ Only electrical circuits may be connected which are safely isolated against high voltage circuits. Safe isolation is achieved, for example, with an isolating transformer, an opto-electronic coupler or when battery-operated.

3.7 Protection Against Dangerous Movements

Dangerous movements can be caused by faulty control of the connected motors. Some common examples are:

- improper or wrong wiring of cable connections
- incorrect operation of the equipment components
- wrong input of parameters before operation
- malfunction of sensors, encoders and monitoring devices
- defective components
- software or firmware errors

Dangerous movements can occur immediately after equipment is switched on or even after an unspecified time of trouble-free operation.

The monitoring in the drive components will normally be sufficient to avoid faulty operation in the connected drives. Regarding personal safety, especially the danger of bodily injury and material damage, this alone cannot be relied upon to ensure complete safety. Until the integrated monitoring functions become effective, it must be assumed in any case that faulty drive movements will occur. The extent of faulty drive movements depends upon the type of control and the state of operation.



Dangerous movements! Danger to life, risk of injury, severe bodily harm or material damage!

- ⇒ Ensure personal safety by means of qualified and tested higher-level monitoring devices or measures integrated in the installation. Unintended machine motion is possible if monitoring devices are disabled, bypassed or not activated.
- ⇒ Pay attention to unintended machine motion or other malfunction in any mode of operation.
- ⇒ Keep free and clear of the machine's range of motion and moving parts. Possible measures to prevent people from accidentally entering the machine's range of motion:
 - use safety fences
 - use safety guards
 - use protective coverings
 - install light curtains or light barriers
- ⇒ Fences and coverings must be strong enough to resist maximum possible momentum, especially if there is a possibility of loose parts flying off.
- ⇒ Mount the emergency stop switch in the immediate reach of the operator. Verify that the emergency stop works before startup. Don't operate the machine if the emergency stop is not working.
- ⇒ Isolate the drive power connection by means of an emergency stop circuit or use a starting lockout to prevent unintentional start.

Make sure that the drives are brought to a safe standstill before accessing or entering the danger zone. Safe standstill can be achieved by switching off the power supply contactor or by safe mechanical locking of moving parts.

- ⇒ Secure vertical axes against falling or dropping after switching off the motor power by, for example:
 - mechanically securing the vertical axes
 - adding an external braking/ arrester/ clamping mechanism
 - ensuring sufficient equilibration of the vertical axesThe standard equipment motor brake or an external brake controlled directly by the drive controller are not sufficient to guarantee personal safety!
 - ⇒ Disconnect electrical power to the equipment using a master switch and secure the switch against reconnection for:
 - maintenance and repair work
 - cleaning of equipment
 - long periods of discontinued equipment use
 - ⇒ Prevent the operation of high-frequency, remote control and radio equipment near electronics circuits and supply leads. If the use of such equipment cannot be avoided, verify the system and the installation for possible malfunctions in all possible positions of normal use before initial startup. If necessary, perform a special electromagnetic compatibility (EMC) test on the installation.
-

3.8 Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated near current-carrying conductors and permanent magnets in motors represent a serious health hazard to persons with heart pacemakers, metal implants and hearing aids.



WARNING

- Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!**
- ⇒ Persons with heart pacemakers, hearing aids and metal implants are not permitted to enter the following areas:
 - Areas in which electrical equipment and parts are mounted, being operated or started up.
 - Areas in which parts of motors with permanent magnets are being stored, operated, repaired or mounted.
 - ⇒ If it is necessary for a person with a heart pacemaker to enter such an area, then a doctor must be consulted prior to doing so. Heart pacemakers that are already implanted or will be implanted in the future, have a considerable variation in their electrical noise immunity. Therefore there are no rules with general validity.
 - ⇒ Persons with hearing aids, metal implants or metal pieces must consult a doctor before they enter the areas described above. Otherwise, health hazards will occur.
-

3.9 Protection Against Contact with Hot Parts



CAUTION

**Housing surfaces could be extremely hot!
Danger of injury! Danger of burns!**

- ⇒ Do not touch housing surfaces near sources of heat!
Danger of burns!
- ⇒ After switching the equipment off, wait at least ten (10) minutes to allow it to cool down before touching it.
- ⇒ Do not touch hot parts of the equipment, such as housings with integrated heat sinks and resistors.
Danger of burns!

3.10 Protection During Handling and Mounting

Under certain conditions, incorrect handling and mounting of parts and components may cause injuries.



CAUTION

Risk of injury by incorrect handling! Bodily harm caused by crushing, shearing, cutting and mechanical shock!

- ⇒ Observe general installation and safety instructions with regard to handling and mounting.
- ⇒ Use appropriate mounting and transport equipment.
- ⇒ Take precautions to avoid pinching and crushing.
- ⇒ Use only appropriate tools. If specified by the product documentation, special tools must be used.
- ⇒ Use lifting devices and tools correctly and safely.
- ⇒ For safe protection wear appropriate protective clothing, e.g. safety glasses, safety shoes and safety gloves.
- ⇒ Never stand under suspended loads.
- ⇒ Clean up liquids from the floor immediately to prevent slipping.

3.11 Battery Safety

Batteries contain reactive chemicals in a solid housing. Inappropriate handling may result in injuries or material damage.



Risk of injury by incorrect handling!

- ⇒ Do not attempt to reactivate discharged batteries by heating or other methods (danger of explosion and cauterization).
- ⇒ Never charge non-chargeable batteries (danger of leakage and explosion).
- ⇒ Never throw batteries into a fire.
- ⇒ Do not dismantle batteries.
- ⇒ Do not damage electrical components installed in the equipment.

Note: Be aware of environmental protection and disposal! The batteries contained in the product should be considered as hazardous material for land, air and sea transport in the sense of the legal requirements (danger of explosion). Dispose batteries separately from other waste. Observe the legal requirements in the country of installation.

3.12 Protection Against Pressurized Systems

Certain motors and drive controllers, corresponding to the information in the respective Project Planning Manual, must be provided with pressurized media, such as compressed air, hydraulic oil, cooling fluid and cooling lubricant supplied by external systems. Incorrect handling of the supply and connections of pressurized systems can lead to injuries or accidents. In these cases, improper handling of external supply systems, supply lines or connections can cause injuries or material damage.



Danger of injury by incorrect handling of pressurized systems !

- ⇒ Do not attempt to disassemble, to open or to cut a pressurized system (danger of explosion).
- ⇒ Observe the operation instructions of the respective manufacturer.
- ⇒ Before disassembling pressurized systems, release pressure and drain off the fluid or gas.
- ⇒ Use suitable protective clothing (for example safety glasses, safety shoes and safety gloves)
- ⇒ Remove any fluid that has leaked out onto the floor immediately.

Note: Environmental protection and disposal! The media used in the operation of the pressurized system equipment may not be environmentally compatible. Media that are damaging the environment must be disposed separately from normal waste. Observe the legal requirements in the country of installation.

Notes

4 Technical Data

4.1 General Notes

Relative humidity:	Operation	75 %, condensation to be avoided	DIN 40 040 Class F
	Storage/transport	95 %, condensation to be avoided	
Air pressure:	Operation	From 860 to 1080 hPa, 1500 m	
	Storage/transport	From 660 to 1080 hPa, 3500 m	
Permissible temperature:	Operation	From 0 to 50 °C, DIN 40 040 Class KV	
	Storage/transport	From -20 °C to +70 °C	
Dimensions (W x H x D):	22 mm x 145 mm x 295 mm		
Weight:	Approx. 0.3 kg		

4.2 Supply Voltage

Nominal value:	+5 V	+12 V	-12 V
Permissible ripple content:	50 mV	120 mV	120 mV
Permissible voltage range:	+4.875	+11.4 V ... +12.6 V	-12.6 V ... -11.4 V
Max. power consumption (+5 V): (MTS-P01.2) (MTS-P02.2)	0.6 A (+ supply voltage for PC/104 modules of up to max. 2.5 A) 1.8 A (+ supply voltage for PC/104 modules of up to max. 2.5 A)		

4.3 EMC

Emitted interference according to EN 55022	Class A (industrial environment)	Specifications only in connection with BTV20/30
Noise immunity according to IEC 1000-4-2 (ESD)	Assessment criterion B	
Noise immunity according to IEC 1000-4-4 (burst)	Assessment criterion B	

4.4 Interfaces

General serial interface (COM):	RS232/RS422/RS485 (D-SUB, 15 pins, female connector)
BT bus:	Rexroth BT bus (D-SUB, 9 pins, female connector)
Optional interfaces:	INTERBUS (D-SUB, 9 pins, female connector) PROFIBUS DP (D-SUB, 9 pins, female connector) 2 x RS232 and 2 x RS422/485 (D-SUB, 9 pins, male connector)

5 Communication

5.1 Communication with the PC

With the PC (CPU), data is exchanged via the standard ISA bus of the industrial PC, which is also used to deliver the voltage supply for the MTS-P0*.2 assembly.

5.2 Communication with the NC Control

An MTS-P0*.2 exchanges data with the NC assembly belonging to the system (MTC-P01.2) via the Rexroth local bus. The local bus is realized via a ribbon cable (50 pins) of the NC control.

The MTS-P0*.2 exchanges data with the NC CPU of the MTA control system via the NC bus in the BTV20.2A, which is designed as ISA bus.

5.3 PLC Inputs for the Machine Function Keys (X8)

If the MTS-P0*.2 is used in an industrial PC of type BTV20/30 of Bosch Rexroth, the machine function keys are directly wired onto the PLC assembly (X8).

If you want to use the machine function keys, select the connection "M keys" via the I/O configurator of WinPCL (see DOK-CONTRL-WinPCL*4VRS). Thereby, the left key bank is assigned to the low-order input byte and the right key bank to the high-order input byte.

5.4 Connection of the BTV20 PLC Function Keys (X12)

The MTS-P0*.2 is provided with 16 inputs and 16 outputs with TTL level. This allows direct connection of the machine operating keys of the BTV20 (including key switch).

Addressing

The PLC function keys, the lamps, the key switch, and the displays of the BTV20 are addressed by assigning a logic user number to the inputs and outputs in the PLC I/O configurator.

This results, for instance, in the following addresses:

- 10 = logic user number of the inputs
- 11 = logic user number of the outputs

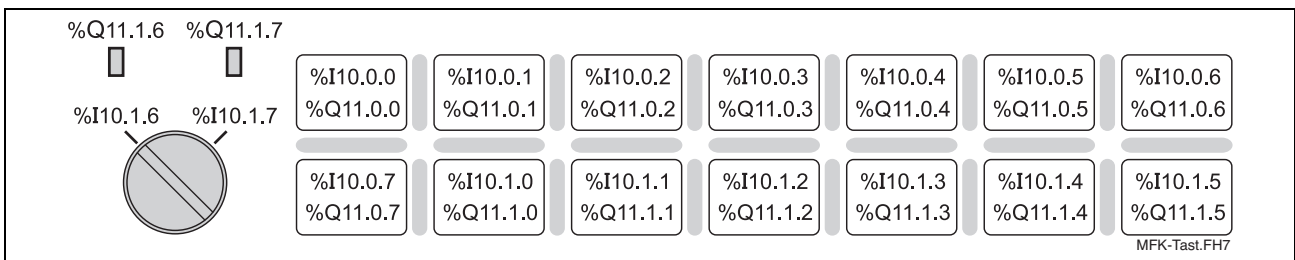


Fig. 5-1: Input and output addresses of the PLC function keys in the BTV20

5.5 PLC Ready (X5)

The PLC ready contact is a relay contact which is closed via a hardware watchdog. It is permanently triggered by the running PLC program. In case of an error (hardware error, firmware error, system error, etc.), the contact is mandatorily opened. The PLC ready contact can, for instance, be wired in the emergency-stop chain of the machine.

5.6 COM Interface (X16)

As a standard, the multimode COM user interface is delivered as an RS232 interface. The parameters for RS422/RS485 operation are set by programming the **OPEN_COM** standard PLC function block and by assigning the **COM** FB input correspondingly. More detailed information can be found in the PLC programming instructions (DOK-CONTRL-WinPCL*4VRS).

5.7 BT Bus (X15)

The BT bus can be used to connect up to four operator terminals of type BTM15/16 or BTA20. The maximum length of the BT bus from the connection point to the last user may be up to **50 m**. This applies both to the connection of only one device and to the connection of the permissible maximum number of 4 devices. It is **not** possible to quickly access the I/O data of the operator terminals from the PLC (e.g. %IBP*.*). Data is exclusively exchanged via the core image storage.

The address assignments required for programming can be found in the respective documents of the devices to be connected.

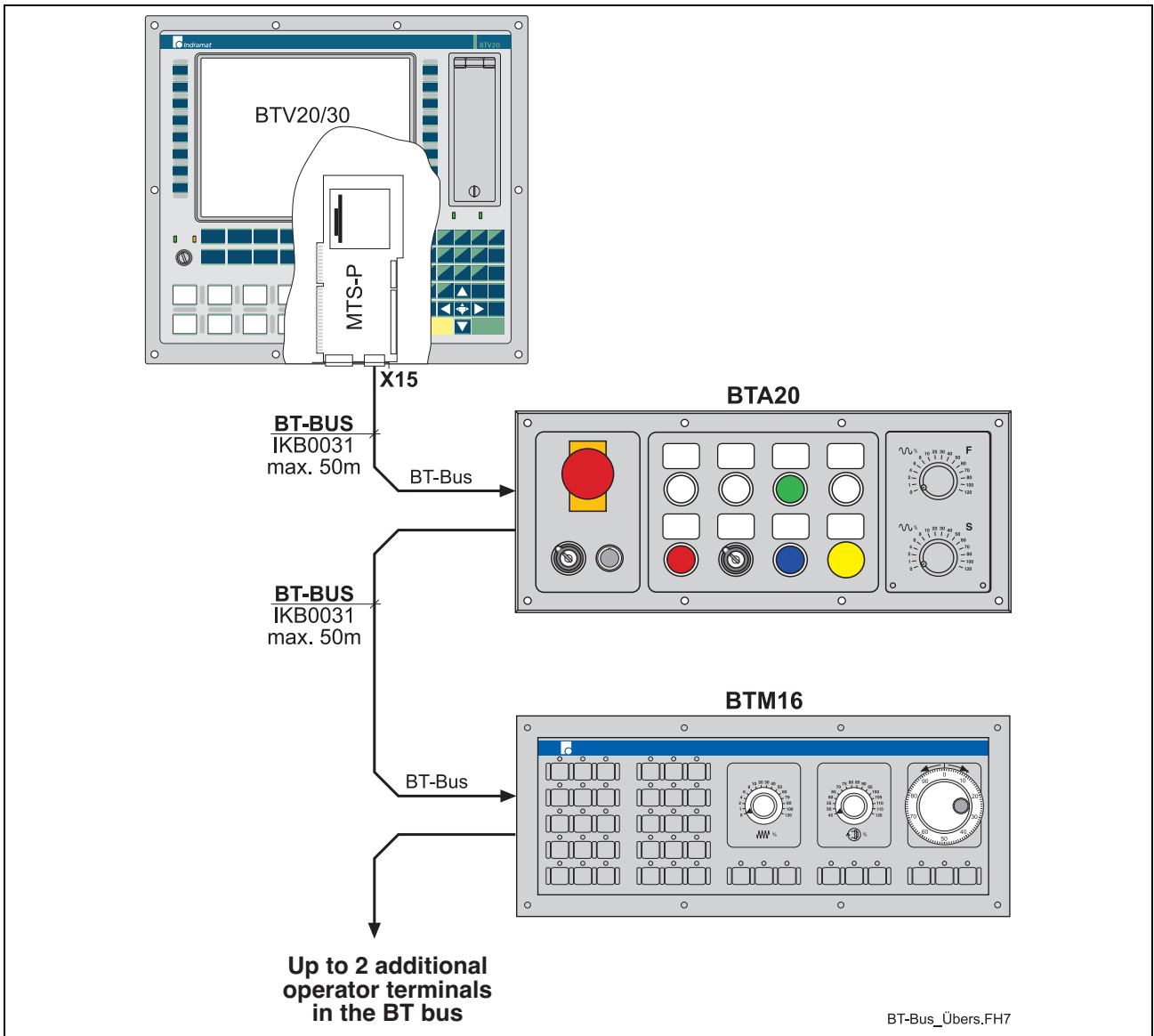


Fig. 5-2: BT bus overview

Addressing

The BT bus is addressed by assigning a logic user number in the I/O editor of the PLC programming interface. Each input core image storage as well as each output core image storage is assigned its own logic address.

Each of the two core image storages has a size of 128 bytes, which are available for the operating devices connected. The number of bytes assigned in the core image storage depends on the operating device (see Fig. 5-3).

Type of device	Storage assignment in the input/output core image
BTM15	Depending on the configuration: 2 bytes for digital I/Os (always assigned) 2 additional bytes for each module (except handwheel) 4 additional bytes for handwheel module
BTM16	14 bytes
BTA20	6 bytes

Fig. 5-3: Storage requirements of operating devices

Depending on the physical order of the operating devices connected to the BT bus, the addresses of the devices are assigned in the input and output core image storage without any gaps, according to the storage requirements of the operating devices. The example (Fig. 5-4) illustrates the principle of the storage assignment of the BT bus.

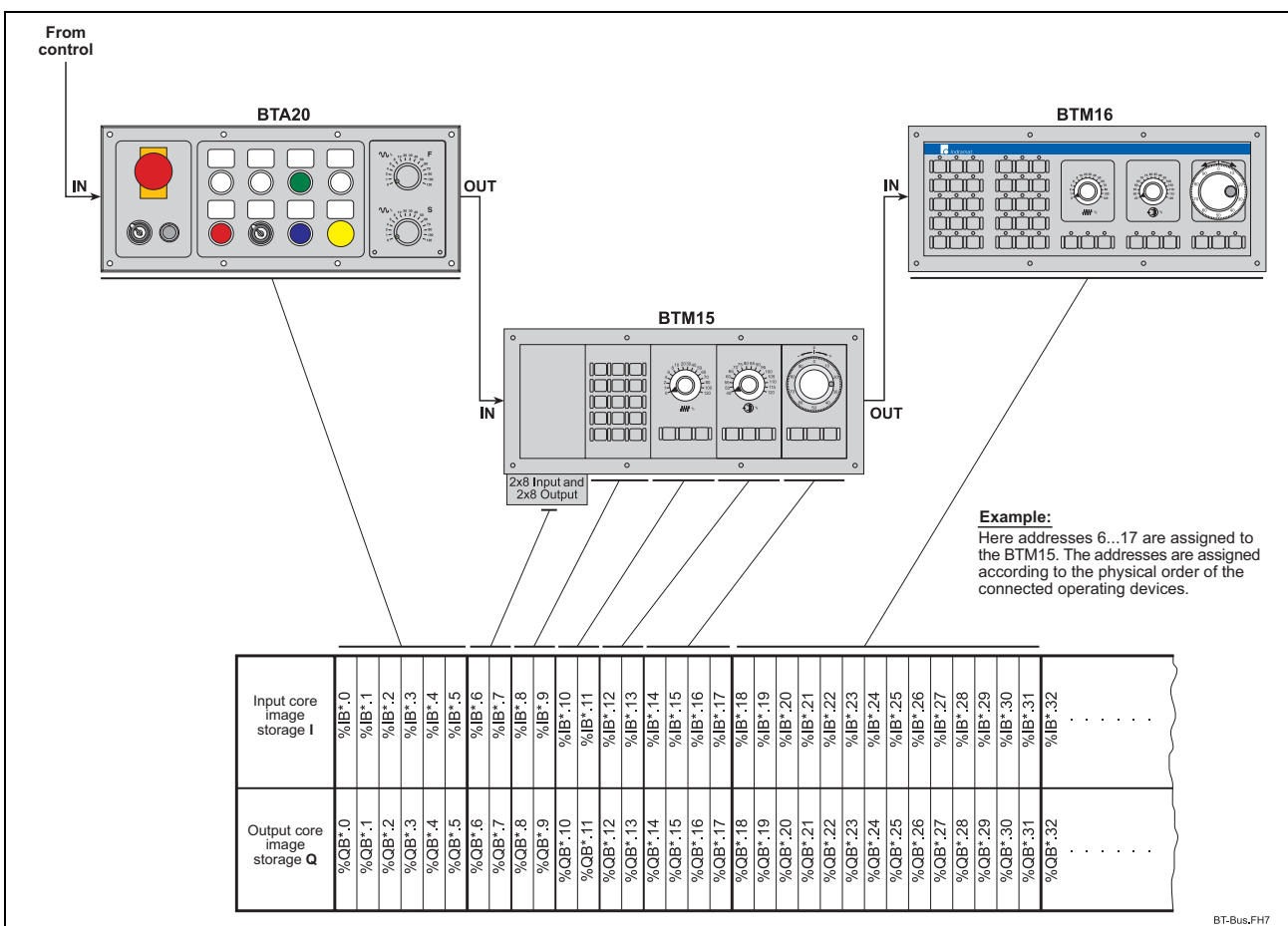


Fig. 5-4: Storage assignment of BT bus

6 Startup

6.1 Mounting

Plug the MTS-P assembly in an unoccupied ISA-BUS slot of your industrial PC. If possible, fix the assembly using the delivered holder, to prevent the card from loosening by shock or vibrations. In the Rexroth BTV20/30 devices, this is realized by means of a transverse rail to which the assemblies including holder are screwed and retained. The holder is an integral part of the configured MTS-P0*.2 assemblies.

Before the MTS-P assembly can be plugged in the PC, some presettings must be made for startup, which will be explained in the following chapters.

Note: Depending on the configuration, i.e. on additional PC/104 modules, an MTS-P assembly can require up to **5** slots in an industrial PC (e.g. BTV20/30).

6.2 Setting of Addresses

General Notes

Before the MTS-P assembly can be plugged in a Rexroth BTV20/30 or in an industrial PC, the addresses must be set. This is achieved by means of the DIP switch represented in Fig. 6-1, depending on the type of control (master/slave). If a slave PLC is used, only the last line in the table is applicable.

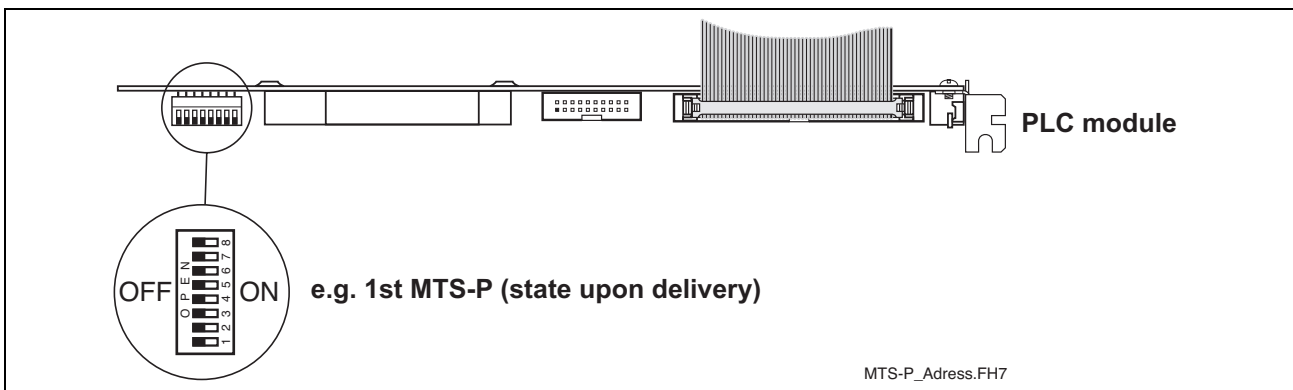


Fig. 6-1: Position of the addressing switch

MTS-P0*.2	1	2	3	4	5	6	7	8	I/O address (hex)
1 st master (default)	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	\$31C
2 nd master (default)	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	\$318
3 rd master (default)	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	\$314
4 th master (default)	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	\$310
	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	\$30C
	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	\$308
	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	\$304
	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	\$300
	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	\$21C
	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF	\$218
	OFF	ON	OFF	ON	OFF	OFF	OFF	OFF	\$214
	ON	ON	OFF	ON	OFF	OFF	OFF	OFF	\$210
	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	\$20C
	ON	OFF	ON	ON	OFF	OFF	OFF	OFF	\$208
	OFF	ON	ON	ON	OFF	OFF	OFF	OFF	\$204
Matching control MTC200	ON	ON	ON	ON	OFF	OFF	OFF	OFF	\$200

Fig. 6-2: DIP switch configuration of the MTS-P0*.2 assemblies

Note: It is absolutely necessary that DIP switch 8 (boot lockout) is set to the **OFF** (OPEN) position, since otherwise the MTS-P0*.2 would not be operable.

6.3 Battery

If an MTS assembly is not operated or is stored for more than **6 months**, user-specific PLC data may get lost.

Data involved The following data is involved:

- PLC user program
- Remanent data

Charging of the battery The battery is charged during startup of an MTS-P assembly. If the battery is **completely discharged**, the following charging times are applicable:

Charging time: 1 h -> approx. 100 h buffer time

Charging time: 50 h -> approx. 5.000 h buffer time (battery fully charged)

Under normal operating conditions, the battery life is 7 to 10 years. Permanent charging of the battery does not affect its life (continuous control operation).

6.4 Status Information and Error Diagnosis

Indication of Operating States

A diagnosis of the MTS-P0*.2 assembly can be made using the seven-segment display H1. The various states are displayed via the one-digit error codes shown below.

Code	Description
-	Power-Fail signal triggered (the control must be reset)
b	Ready for operation (PLC is running)
0.	Startup state (reset test)
F.	Firmware in the Flash EPROM not valid
J.	Boot lockout for firmware activated
S	System stack overflow
P	Local bus not connected

Fig. 6-3: Operating states of the MTS-P0*.2

Note: If any other one-digit code (followed by a full stop) is displayed, the customer service must be notified **immediately**.

Indication of Errors

Error states are indicated by **three-digit** error codes on the successively flashing seven-segment display. The error codes represented correspond to the system error messages of the user interface BOF/GBO.

Code	Description
007	Software version error
008	Self-test unsuccessful
052	PLC program not valid
055	Max. cycle time of the PLC exceeded
071	Operating voltage of the PLC too low
081	Time exceeded 2-ms implementation
082	INTERBUS failure
083	INTERBUS storage overflow
084	INTERBUS configuration error
085	INTERBUS bus error
086	INTERBUS hardware / firmware error
087	INTERBUS module error of peripheral bus
088	INTERBUS not ready
089	INTERBUS general error of generation 4
090	PROFIBUS error when initializing
093	BT bus error

Fig. 6-4: Error codes of the MTS-P0*.2

6.5 Interface Assignment

The assignments of the interfaces of the MTS-P assemblies are shown in the tables below.

PIN	Signal name	PIN	Signal name
1	NC	2	Transmit Data (RS232)
3	Receive Data (RS232)	4	RS485+ or RxD+ (RS422)
5	RS485- or RxD- (RS422)	6	NC
7	GND	8	NC
9	TxD+ (RS422)	10	GND
11	TxD- (RS422)	12	+5 V
13	Request To Send (modem)	14	Clear To Send (modem)
15	NC		

Fig. 6-5: Pin assignment of the COM interface X16

PIN	Signal name	PIN	Signal name
1	Data Out +	2	Data In +
2	GND	4	NC
5	+5 V	6	Data Out -
7	Data In -	8	NC
9	Assignment detection		

Fig. 6-6: Pin assignment of the BT bus X15

PIN	Function
X1.1 – X1.4	Supply voltage V _{CC}
X1.5 – X1.20	Input (0...15)
X1.21 – X1.36	Output (0...15)
X1.37 – X1.40	GND

Fig. 6-7: Pin assignment of the 40-pin I/O connector X12

PIN	Signal name	PIN	Signal name
1	+5 VDC	2	+5 VDC
3	S0	4	S1
5	S2	6	S3
7	S4	8	S5
9	S6	10	S7
11	S8	12	S9
13	S10	14	S11
15	S12	16	S13
17	S14	18	S15
19	GND	20	GND

Fig. 6-8: Pin assignment for the machine function keys X8

7 INTERBUS Master Connection

7.1 Brief Description

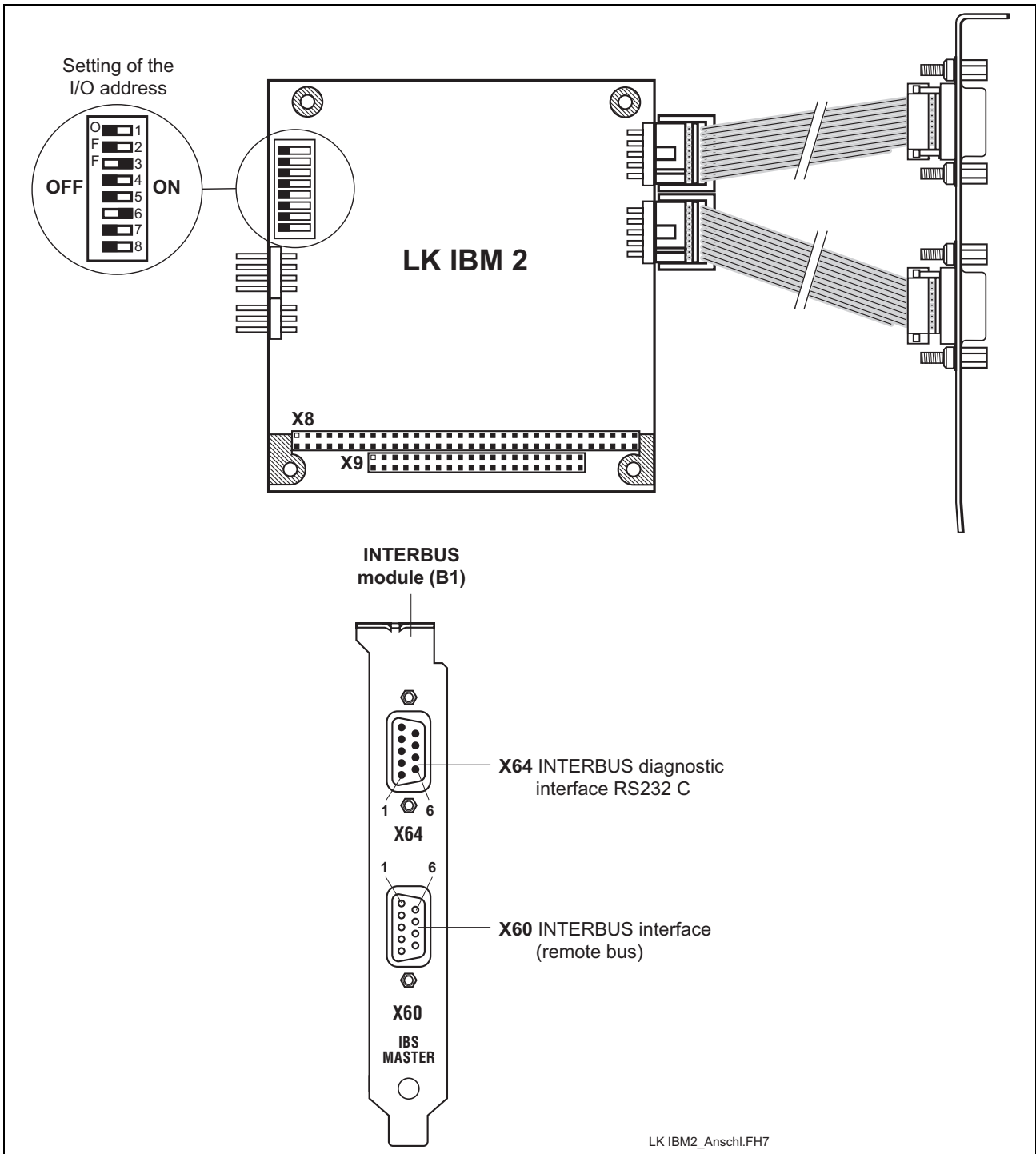


Fig. 7-1: P.C.B. IBM2

The printed circuit board IBM 2 is an INTERBUS master connection of the 4th generation in PC104 format. It can be used for the connection of simple sensors and actuators as well as of intelligent field devices via the INTERBUS. The INTERBUS permits bridging of distances of up to 12.8 km (from the connection point to the last connected remote bus user), divided in segments of up to 400 m.

The P.C.B. IBM 2 has the following features:

- INTERBUS protocol (DIN E 19 258),
- up to 256 bus segments,
- up to 16 user levels,
- up to 512 users per configuration,
- up to 4096 inputs and 4096 outputs per configuration (512 bytes),
- up to 32 INTERBUS loop users per bus segment,
- CMD G4 support.

The configuration and commissioning of the INTERBUS occurs via the INTERBUS configurator IBS CMD G4 (see DOK-CONTRL-IBS*CMD****) and the I/O editor of the WinPCL programming surface (see DOK-CONTRL-WinPCL*4VRS). For this configuration the interface cable IKB0030 is required.

7.2 Setting of the I/O Address

The setting of the DIP switch S1 must be as follows (default setting), so that the P.C.B. IBM 2 can be addressed via the PC/104 bus:

1	2	3	4	5	6	7	8	Address
OFF	OFF	ON	OFF	OFF	ON	OFF	OFF	120 _h

Fig. 7-2: Setting of DIP switch S1

7.3 Technical Data

Supply	
Operating voltage:	+5 VDC, 5 % / 400 mA
Interface data	
Communication interface:	2-wire remote bus; RS422, without electrical isolation
Diagnostic interface:	RS232C
Operating conditions	
Operating temperature:	0 °C - +55 °C
Storage temperature:	-25 °C - +70 °C
Relative humidity:	Max. 75 %, condensation to be avoided

7.4 Interface Assignment

Pin	Signal name	Pin	Signal name
1	NC	2	$\overline{\text{TxD}}$ - Transmit Data
3	$\overline{\text{RxD}}$ - Receive Data	4	NC
5	SGND - Ground	6	NC
7	RTS - Ready To Send	8	CTS - Clear To Send
9	NC		

Fig. 7-3: Pin assignment of the INTERBUS diagnosis interface **X64** (RS232 C)

Pin	Signal name	Pin	Signal name
1	DO	2	DI
3	COM	4	GND
5	+5 V	6	$\overline{\text{D0}}$
7	$\overline{\text{DI}}$	8	Vcc
9	RBST		

Fig. 7-4: Pin assignment of the INTERBUS interface **X60** (remote bus)

8 PROFIBUS DP Connection

8.1 Brief Description of Master and Slave Connection

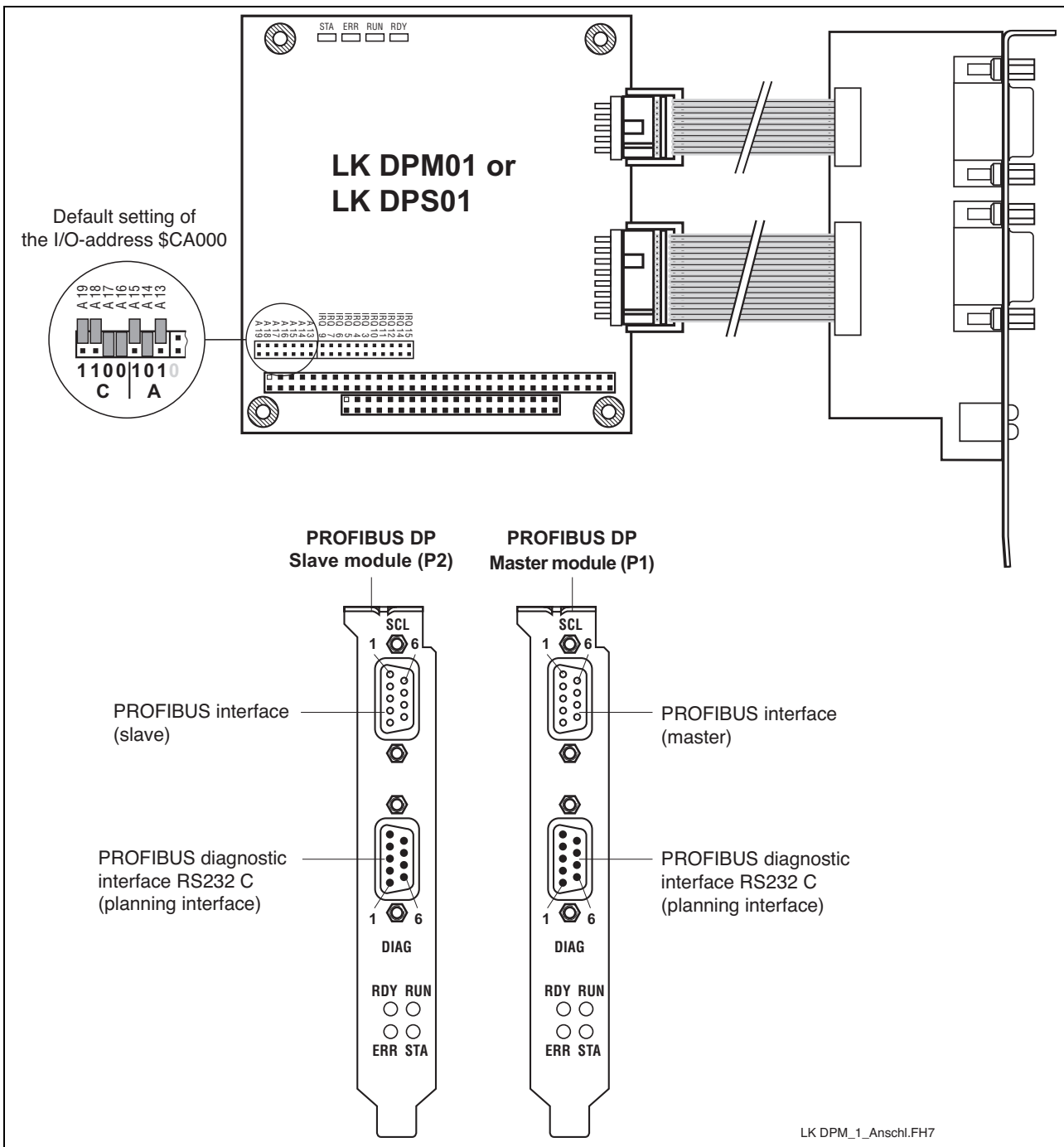


Fig. 8-1: PROFIBUS connections

The P.C.B.s DPM01 (master) and DPS01 (slave) are intelligent PROFIBUS DP connections in PC104 format. They are used to process the protocols of the data transfer between the PLC and the distributed PROFIBUS input and output units. The built-in microprocessor allows automatic execution of the entire data transfer, thus relieving the PLC of real-time tasks.

Data exchange between the PLC and the P.C.B.s DPM01 and DPS01 is implemented via an 8-kbyte dual-port memory (DPM). The DPM is a memory which can be simultaneously accessed by the PLC and the microprocessor of the P.C.B.s DPM01 and DPS01.

Configuration and commissioning of the P.C.B. DPM/DPS01 occurs by means of the system configurator SyConPB (see DOK-CONTRL-SYCON****DP). For this configuration interface cable IKS0106 is required. The PROFIBUS DP master connection permits to connect up to 32 PROFIBUS DP devices within one bus segment. If several bus segments are connected to each other via a repeater, a maximum of 125 slaves can be operated with maximum configuration. Each repeater in use reduces the maximum number of slaves within one segment, with the repeater as a passive user being not assigned to any user address.

In relation to the set data transfer rate, link lengths of up to 1200 m can be realized between the PROFIBUS DP users. With a data transfer rate of 1.5 mbaud, the link lengths are reduced to max. 200 m, with a rate of 12 mbaud to max. 100 m.

The master LK DPM01 can be connected to a maximum of 244 bytes inputs and 244 bytes outputs. The total amount of all inputs and outputs must not exceed 512 bytes.

Slave LK DPS01 has to be configured only in a manner that the total amount of the module's inputs and outputs is 244 bytes each. It has to be considered that the total amount of the inputs and outputs of all modules does not exceed 368 bytes.

Note: In order to ensure proper functioning of the PROFIBUS interface, only the cables IKB0033 or IKB0034 or cables meeting the PROFIBUS specification RS485 (cable type A) may be used.

8.2 Setting the I/O Addresses

The bus address is set using the jumpers of plugboard J2. The address line is specified next to each jumper.

Depending on the expansion slot, the addresses must be set as follows (X = jumper fitted):

Slot	Address	A19	A18	A17	A16	A15	A14	A13
1	\$CA000			X	X		X	
2	\$CC000			X	X			X

Fig. 8-2: Setting of the I/O address

8.3 Status and Diagnostic Information

After having been switched on, the P.C.B.s DPM01 and DPS01 perform a self-test. After the initialization phase of this test (2 to 3 seconds), the two LEDs **ERR** and **STA** turn dark, and the yellow **RDY** LED emits light if the test is completed successfully. If not, the **RDY** LED starts flashing, and processing of the program is stopped. The further meanings of the indicators during the initialization phase are listed below.

RDY	Yellow LED	Ready
	On:	DPM01 or DPS01 ready for operation
	Flashes in cycles:	Bootstrap loader active
	Flashes irregularly:	Hardware or system error
	Off:	Hardware defective
RUN	Green LED	RUN (communication)
	On:	Communication is running
	Flashes in cycles:	Ready for communication
	Flashes irregularly:	Wrong configuration
	Off:	No communication
ERR	Red LED	Error
	On:	Error of the communication interface
	Off:	Communication interface OK
STA	Yellow LED	Status
	On:	Data exchange with slaves active (master) Data exchange with master active (slave)
	Off:	No data exchange

8.4 Technical Data

Supply	
Operating voltage:	+5 VDC, $\pm 5\%$ / 650 mA
Interface data	
Communication interface:	PROFIBUS DP, max. 12 mbaud, potential-free
Diagnostic interface:	RS 232C, 9600 baud
Operating conditions	
Operating temperature:	0 °C to +55 °C
Storage temperature:	-25 °C to +70 °C
Relative humidity:	Max. 75%, condensation to be avoided

8.5 Interface Assignment

The assignments of the interfaces of the PROFIBUS connections are as follows:

PIN	Signal name	PIN	Signal name
1	NC	2	RxD - Receive Data
3	TxD - Transmit Data	4	DTR - Data Terminal Ready
5	GND - Operating ground	6	NC
7	RTS - Ready To Send	8	CTS - Clear To Send
9	NC		

Fig. 8-3: Pin assignment of the diagnostic interface RS232C (**X74, X79**)

PIN	Signal name	PIN	Signal name
1	RGND - Reference ground	2	NC
3	RxD/TxD-P - Send/receive	4	NC
5	DGND - Reference potential	6	VP - Supply voltage plus
7	NC	8	RxD/TxD-N - Send/receive
9	NC		

Fig. 8-4: Pin assignment of the PROFIBUS interface (**X70, X75**)

9 DeviceNet Master Connection

9.1 Brief Description

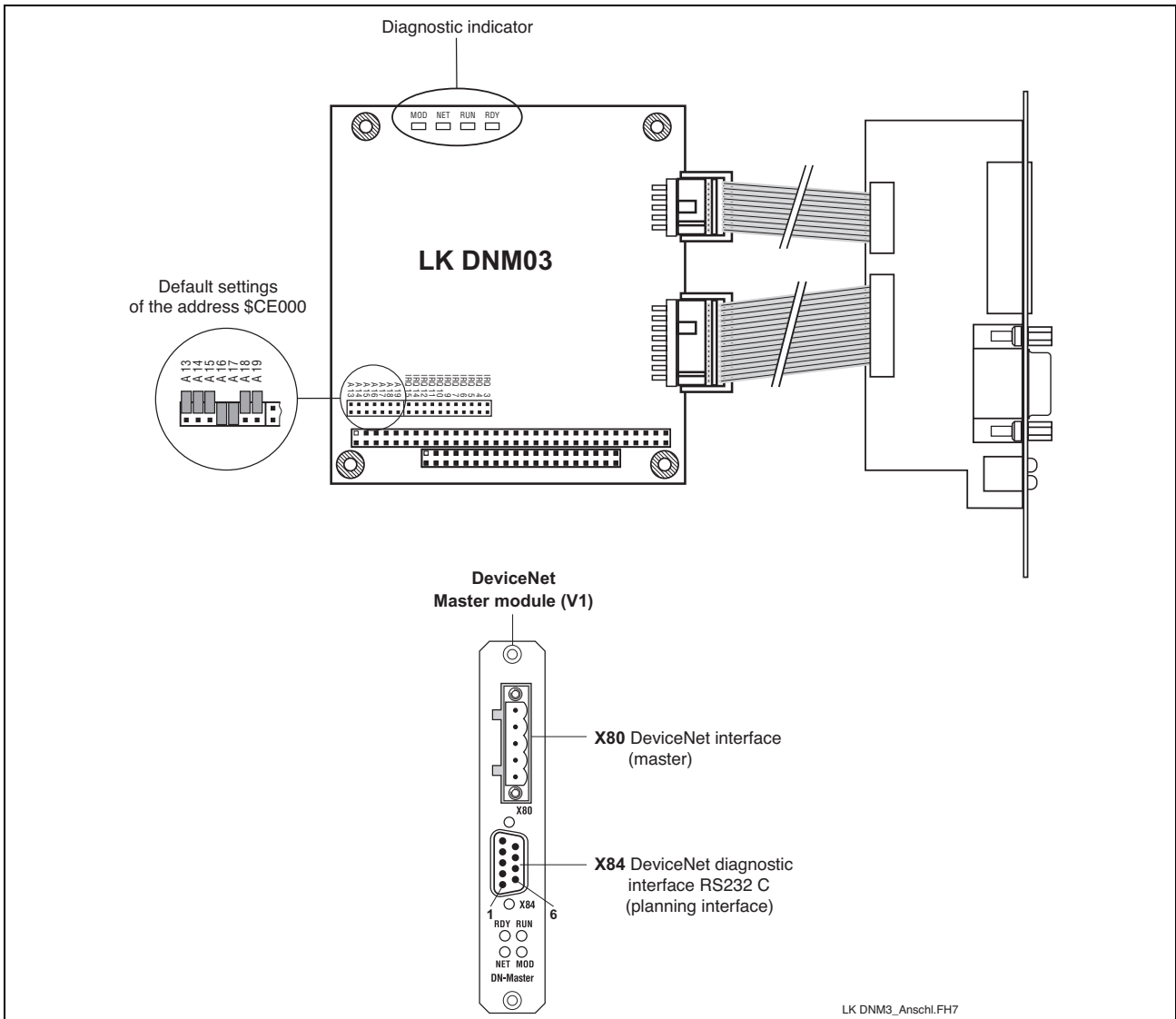


Abb. 9-1: LK DNM03

The printed circuit board DNM03 is an intelligent DeviceNet master connection in PC104 format. As master it exchanges automatically data between the bus devices and an internal process image and therefore does not charge the PLC. The process image is saved in the dual-port memory and is, for this, directly available to the application. The LK DNM03 can operate at the bus cable of branch lines up to 63 DeviceNet slaves each with maximum 256 bytes inputs and outputs per slave (maximum 7 kbytes).

The total length of the bus cable depends on the cable type or the transmission rate and must not exceed the following lengths:

Baud rate	Maximum length for cable type		
	Thick cable	Thin cable	Thick/thin cable
125 kbit/s	500 m	100 m	$L_{\text{thick}} + 5 \times L_{\text{thin}}$ 500 m
250 kbit/s	250 m	100 m	$L_{\text{thick}} + 2,5 \times L_{\text{thin}}$ 250 m
500 kbit/s	100 m	100 m	$L_{\text{thick}} + L_{\text{thin}}$ 100 m

Fig. 9-2: Maximum cable length depending on the used cables

Note: To guarantee a correct function of the DeviceNet interface, the cable is to be used according to the DeviceNet specifications. Furthermore, it is mandatory that both cable ends of the bus segment are terminated with 120 Ohm.

Single branch lines must not be longer than 6 m. The total length of all branch lines must not exceed 156 m for 125 kbaud, 78 m for 250 kbaud and 39 m for 500 kbaud.

The configuration and commissioning of the LK DNM03 occurs by means of the system configurator SyCon (see DOK-CONTRL-SYCON****DN). It communicates via a serial connection between the COM-Port of the PC and the diagnostic interface X84 of the LK DNM03. The configuration is saved on the LK DNM03 and is therefore immediately available after the start.

The technical data of the LK DNM03 are as follows:

- Process image with maximum 7 kbytes (inputs and outputs)
- 16 bit processor with interrupt and DMA controller
- 8 kb DPM, 512 kb Flash and 128 kb RAM
- CAN Controller SJA 1000
- Isolated DeviceNet interface according to ISO11898, maximum 500 kbaud
- Non-isolated diagnostic interface RS232C, 9600 baud

9.2 Status and Diagnostic Indicators

After having been switched on, the DNM03 performs a self-test. After the initialization phase of this test (2 to 3 seconds), the yellow RDY LED flashes yellow. If not, the RDY LED starts flashing, and processing of the program is stopped. The further meanings of the indicators during the initialization phase are listed below.

RDY	Yellow LED:	Ready
	On:	DPM01 or DPS01 ready for operation
	Flashes in cycles:	Bootstrap loader active
	Flashes irregularly:	Hardware or system error
	Off:	Hardware defective
RUN	Green LED:	RUN (communication)
	On:	Communication is running
	Flashes in cycles:	Ready for communication
	Flashes irregularly:	Missing or wrong configuration
	Off:	No communication
NET	Green LED:	Communication at the bus established
	Flashes green:	No communication at the bus
	Red LED:	Critical connection error
	Flashes red:	Time monitoring error
	Off:	No operating voltage at the bus
MOD	Green LED:	Device is working
	Flashes green:	Ready for operation
	Red LED:	Not correctable error
	Flashes red:	Subordinated error
	Off:	No operating voltage

9.3 Setting the I/O Address

The setting of the starting address occurs via the plug-in jumpers of plugboard J4. Thereby, besides each plug-in jumper the corresponding address line is specified.

When using the board in conjunction with WinPCL the starting address is to be set as follows (X = plug-in jumper plugged):

Address	A13	A14	A15	A16	A17	A18	A19
\$CE000				X	X		

Fig. 9-3: Setting of the I/O address

9.4 Technical Data

Supply	
Operating voltage:	+5 V \pm 5 % / 650 mA
Operating voltage DeviceNet interface:	+11 -25 V / 55 mA
Interface data	
Communication interface:	ISO 11898, max. 500 kbaud, isolated
Diagnostic interface:	RS232C, 9600 baud, non-isolated
Operating conditions	
Operating temperature:	0 to +55
Storage temperature:	- 25 °C - +70 °C
Relative humidity:	Max. 75 %, condensation to be avoided

Fig. 9-4: Technical data

9.5 Interface Assignment

Pin	Signal name	Pin	Signal name
1	NC	2	RxD – Receive Data
3	TxD – Transmit Data	4	DTR – Data Terminal Ready
5	GND – Functional earth ground	6	NC
7	RTS – Ready to send	8	CTS – Clear To Send
9	NC		

Fig. 9-5: Pin assignment of the DeviceNet diagnostic interface **X84**

Pin	Signal name	Signal color
1	Ground	Black
2	CAN_LOW	Blue
3	Shield	--
4	CAN_High	White
5	+ 24V	Red

Abb. 9-6: Pin assignment of the DeviceNet interface **X80**

10 Serial Interfaces

10.1 Brief Description

The P.C.B. SIO 04-B provides the PLC user program with up to four serial interfaces (RS232 and RS422/485) for general use. Operation of the serial interfaces is interrupt-controlled via the PLC firmware.

The send and receive data of each interface are made available in buffers of 256 bytes length each. Using these buffers, the PLC user program indirectly communicates with the interfaces via available function blocks.

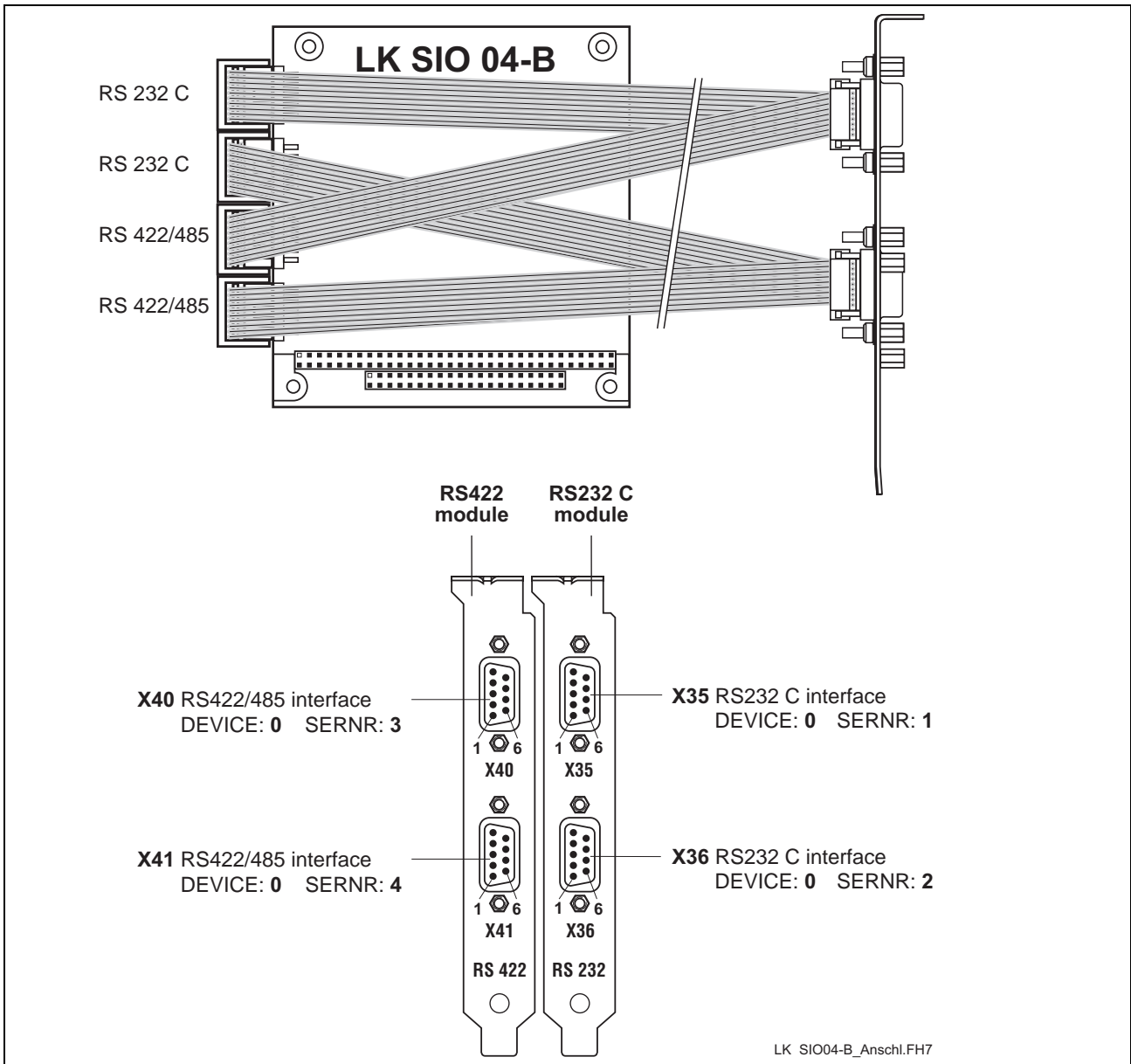


Fig. 10-1: P.C.B. SIO 04-B

10.2 Addresses and Interrupt Settings

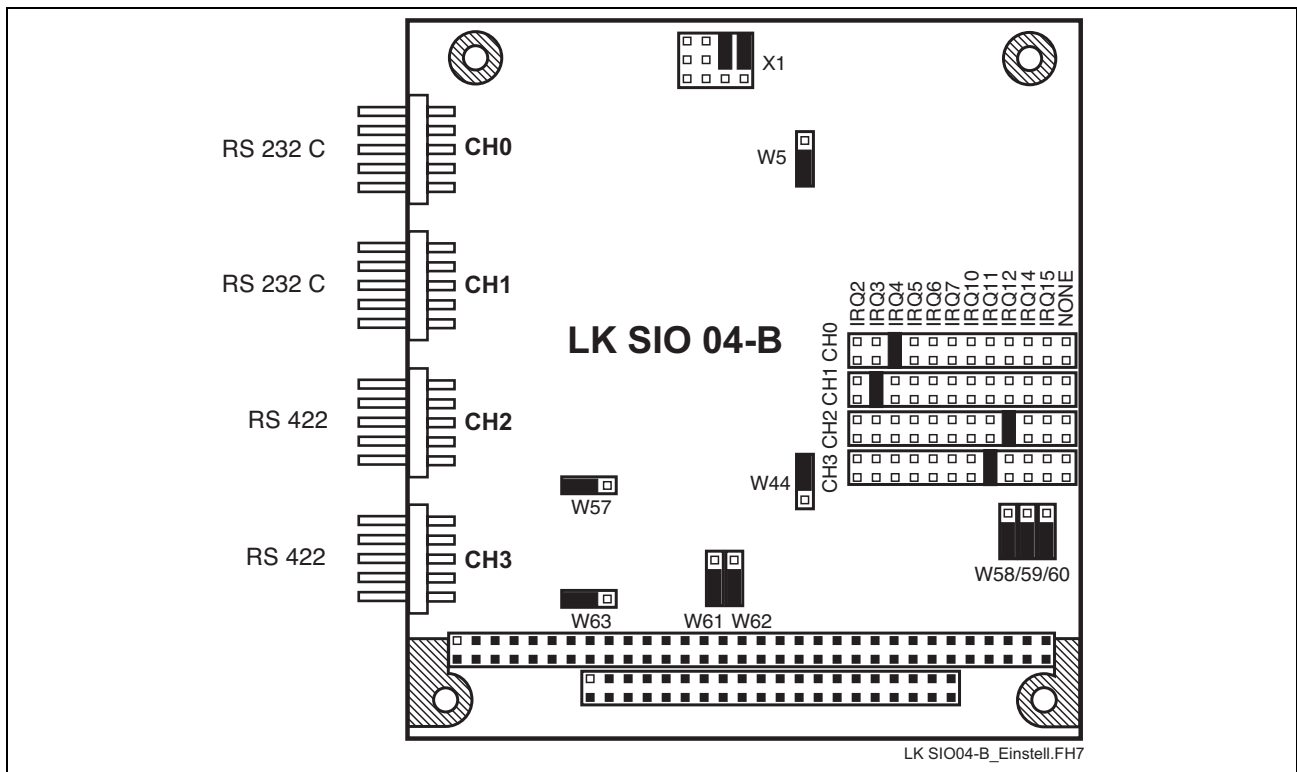


Fig. 10-2: Jumper settings on the P.C.B. SIO 04-B

10.3 Function Blocks

Using the following function blocks, the PLC program permits access to the serial interface.

Name	Description
OPEN_COM	Parameterizing and opening a serial interface
CLOSE_COM	Closing a serial interface
RD_BYTE	Reading a byte from the serial interface
WR_BYTE	Writing a byte to the serial interface
RD_STR	Reading a string from the serial interface
WR_STR	Writing a string to the serial interface
CTRL_COM	Determination of the serial status of the serial interface
CLR_COM	Determination of the receiver and transmitter buffer of the serial interface
BTXX	Communication module for the operating and visualization devices BTV04/05 and BTC06

Fig. 10-3: Function blocks for interface handling

The COM data type, which describes the serial interface in more detail (e.g. DEVICE, SERNR, BAUDRATE, etc.), is required for parameterizing the blocks. For a more detailed description of the function blocks see documentation "DOK-CONTRL-WINPCL*4VRS".

10.4 Technical Data

Supply	
Supply voltage:	4.5 to 5.5 VDC
Current consumption:	Max. 250 mA
Interface data	
Input capacity:	Max. 15 pF
Input leakage current:	Max. 5 μ A
Output capacity:	Min. 150 pF
Output current (switching actively 0):	Min. 12 mA

10.5 Interface Assignment

The assignments of the serial interfaces are as follows:

PIN	Signal name	PIN	Signal name
1	DCD / Data Carrier Detect	2	RxD / Receive Data
3	TxD / Transmit Data	4	DTR / Data Terminal Ready
5	SGND / Ground	6	DSR / Data Set Ready
7	RTS / Ready To Send	8	CTS / Clear To Send
9	RI / Ring Indicator		

Fig. 10-4: Pin assignment of RS 232C X35, X36

PIN	Signal name	PIN	Signal name
1	GND / Frame Ground	2	NC
3	TxD A (-) / Transmit Data	4	RxD A (-) / Receive Data
5	SGND / Signal Ground	6	RxD B (+) / Receive Data
7	RTS / Ready To Send	8	CTS / Clear To Send
9	TxD B (+) / Transmit Data		

Fig. 10-5: Pin assignment of RS422/485 X40, X41

11 Connection of Operator Terminals

11.1 Applications with the BTV04/05/06

As required, the operator terminals BTV04/05/06 are connected via the serial interfaces X16 and X40/41, which permit RS422 or RS485 operation. Only **one** operator terminal can be connected to an RS422 interface (see Fig. 11-1).

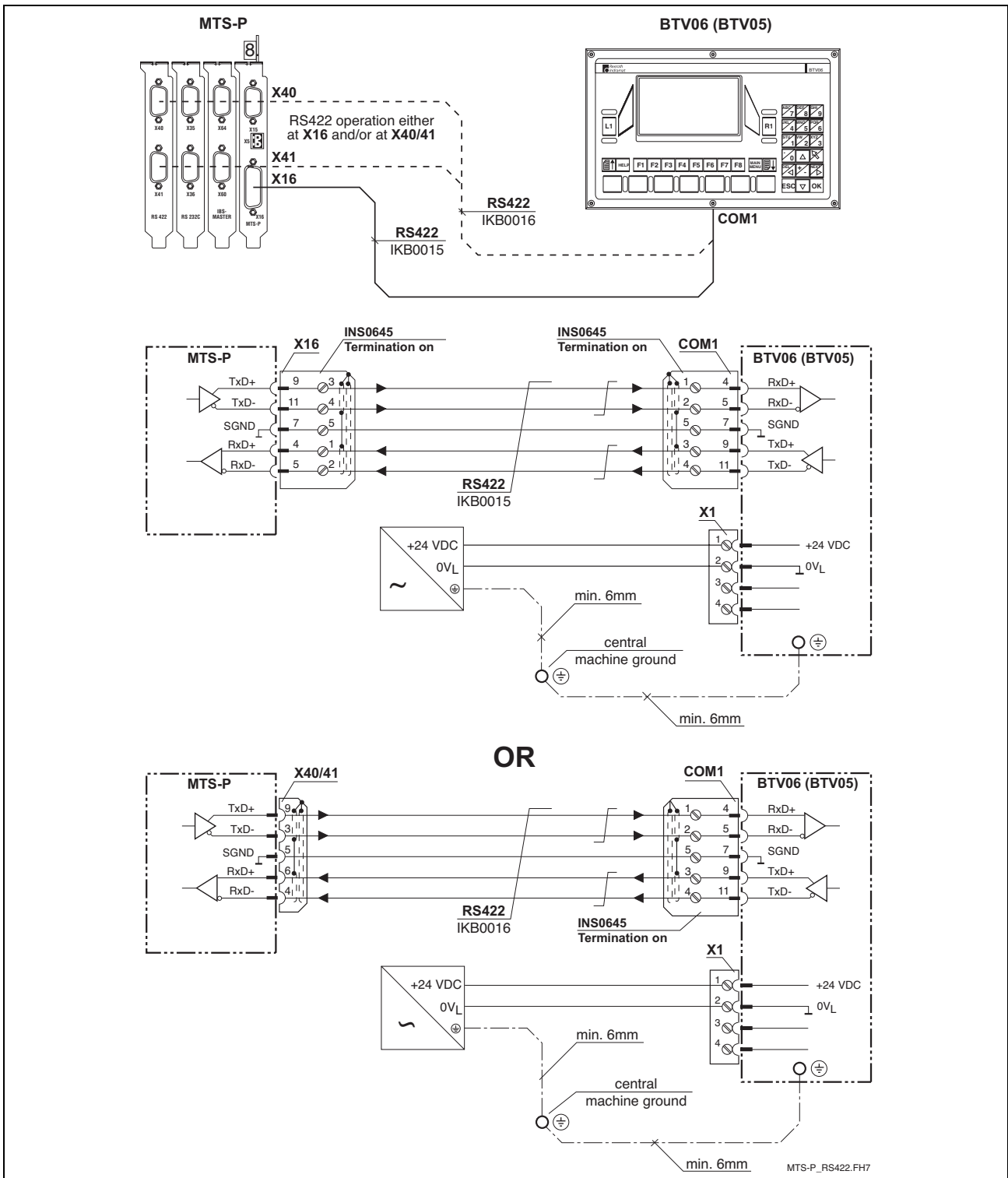


Fig. 11-1: MTS-P with operator terminals via an RS422 interface

During RS485 operation, 2 operator terminals can be connected in cascade per interface (see Fig. 11-2). Hence, a maximum of 6 operator terminals can be connected during RS485 operation.

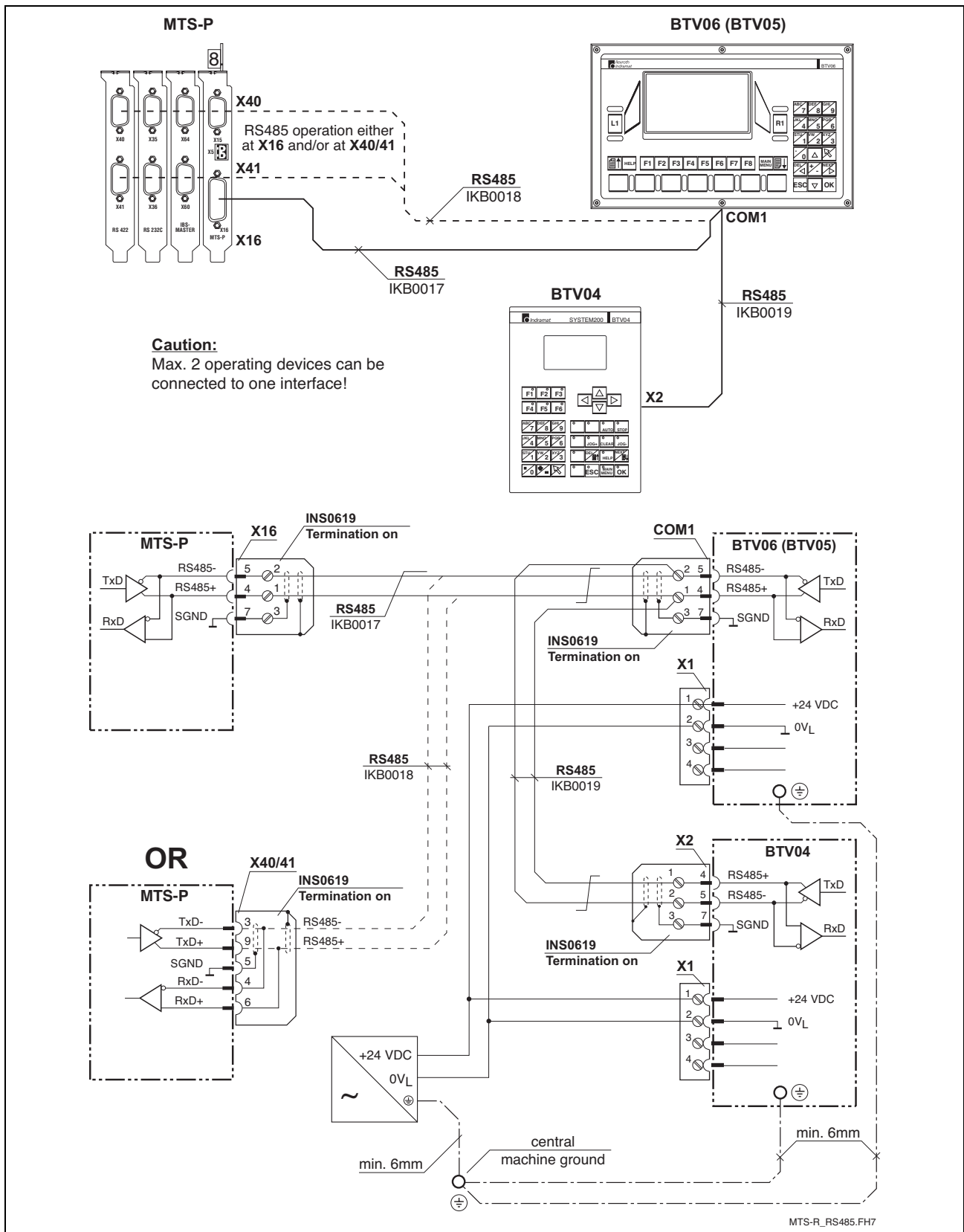


Fig. 11-2: MTS-P with operator terminals via an RS485 interface

11.2 Applications with the BTC06

The mobile operator terminals BTC06 are exclusively connected via the machine control panels BTA10 or BTA20. RS232 operation is converted to RS422 operation by means of the interface converter integrated in the BTA10/20 (see Fig. 11-3). RS422 operation with the BTC06 is also only possible via the BTA10/20. Here, however, there is no interface conversion, but only an adaptation of the interface connectors to the BTC06 connector (see Fig. 11-4).

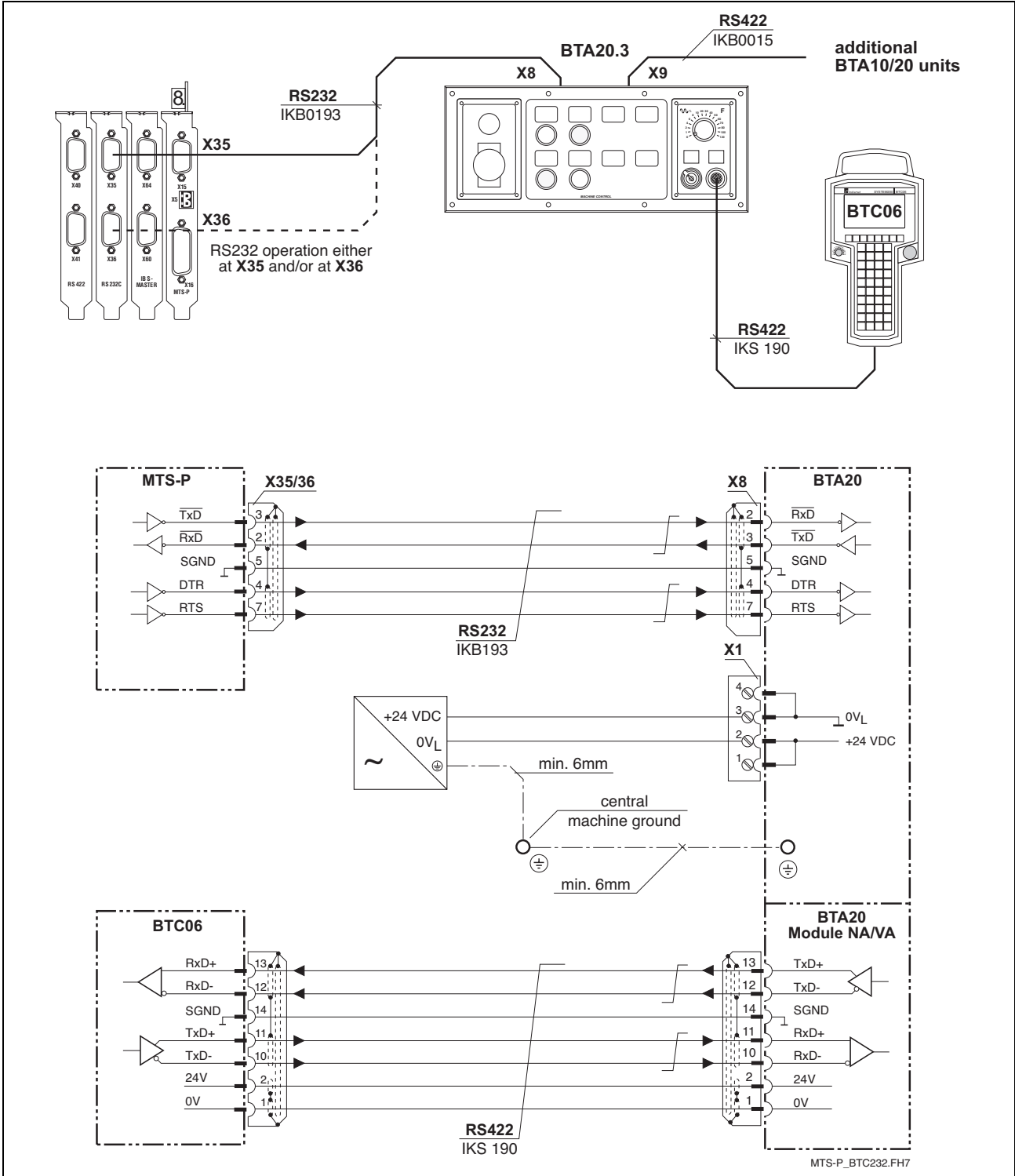


Fig. 11-3: MTS-P with BTC06 via an RS232 interface

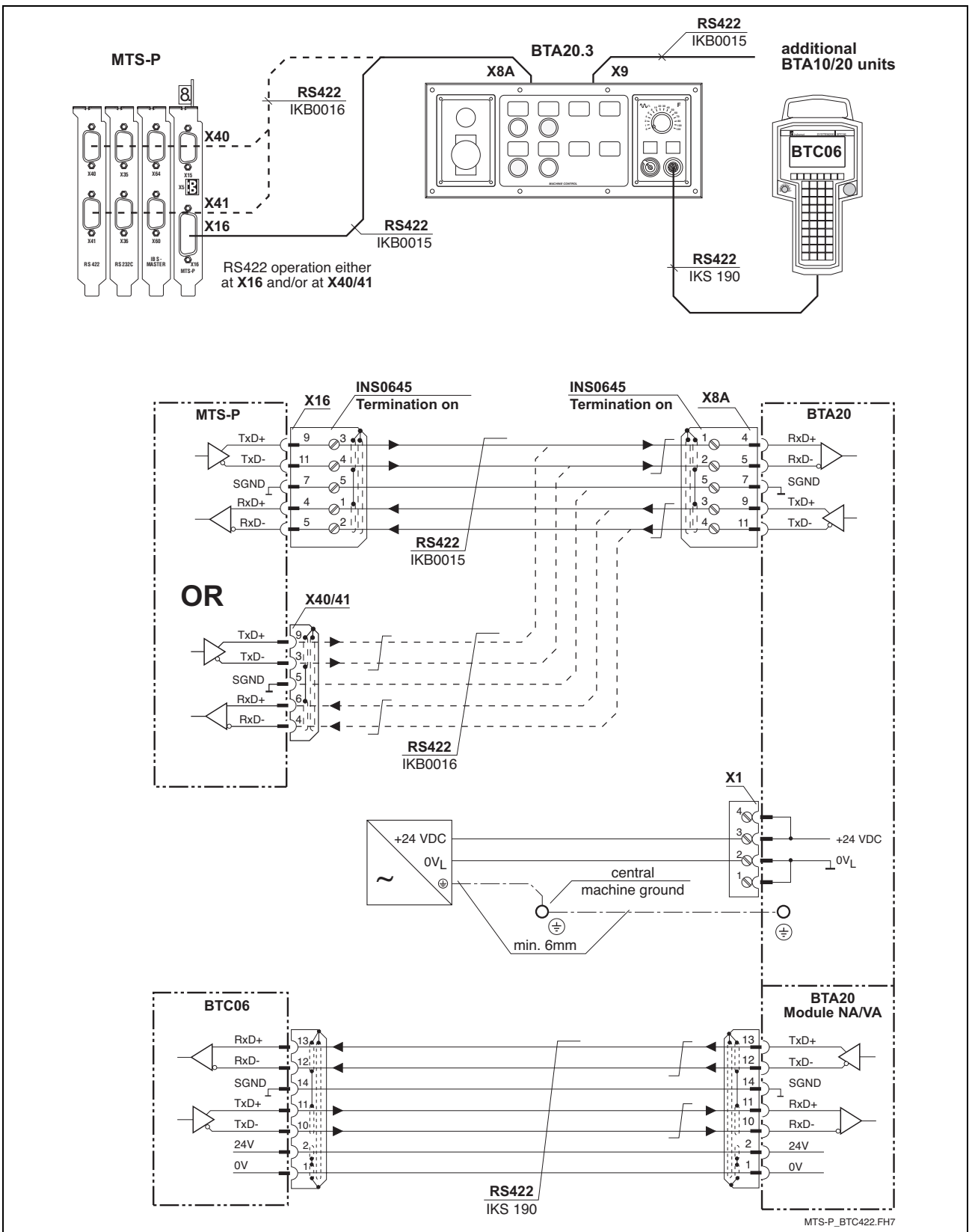


Fig. 11-4: MTS-P with BTC06 via an RS422 interface

12 Configurations

12.1 MTS-P0*.2-D2-B1-NN-NN-NN-FW

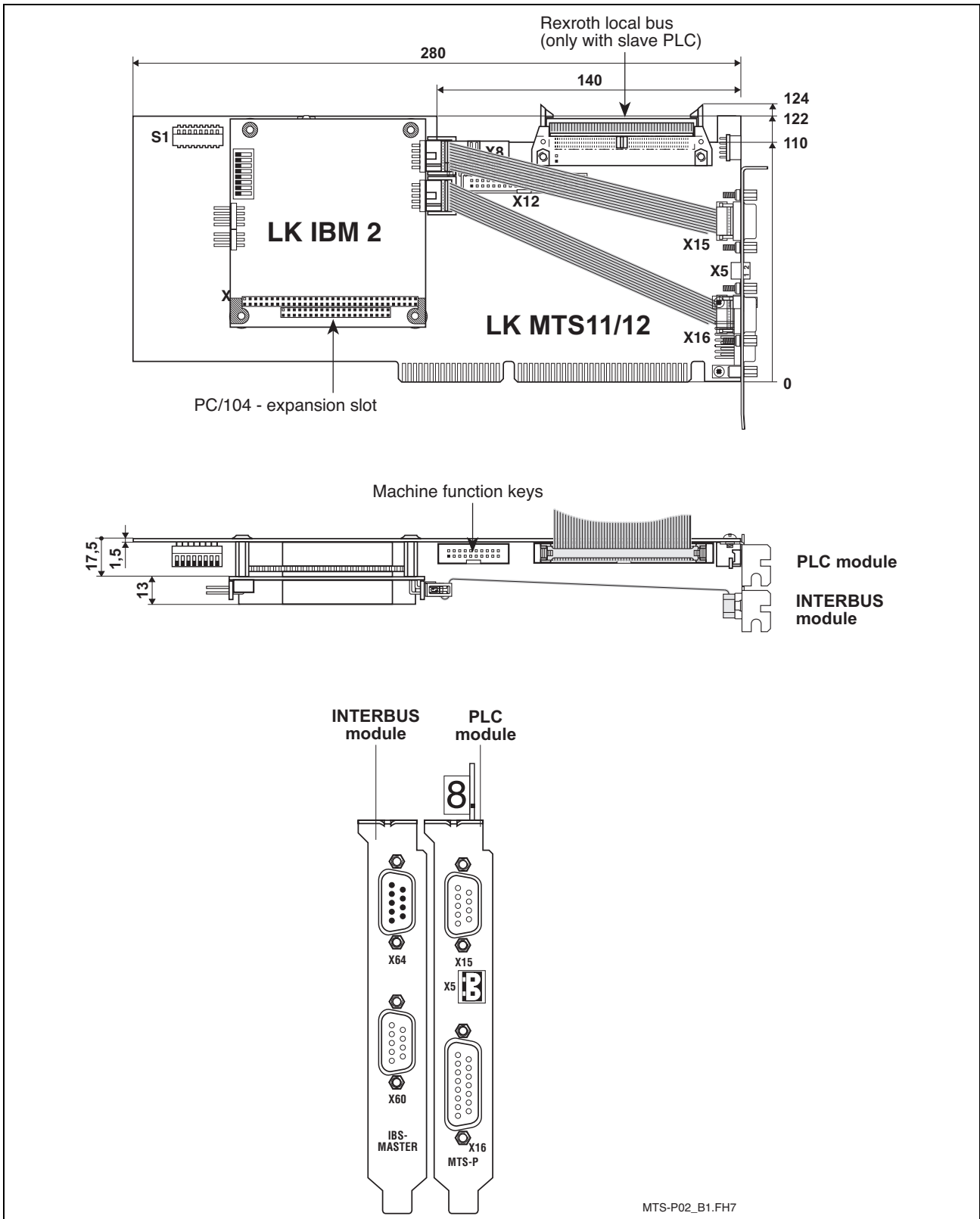


Fig. 12-1: Setup of the MTS-P0*.2-D2-B1-NN-NN-NN-FW configuration

12.2 MTS-P0*.2-D2-B1-S4-NN-NN-FW

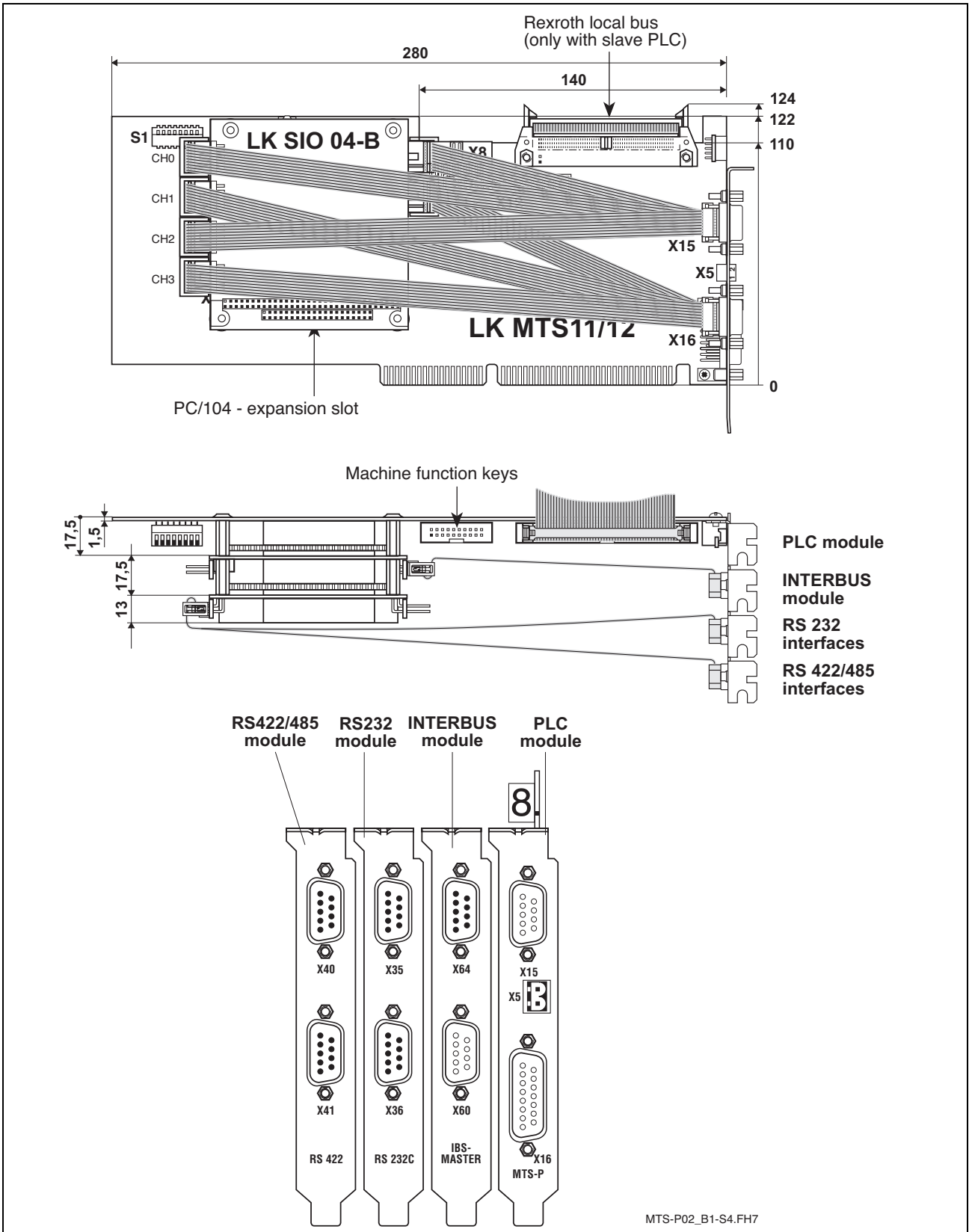


Fig. 12-2: Setup of the MTS-P0*.2-D2-B1-S4-NN-NN-FW configuration

12.3 MTS-P0*.2-D2-P1-NN-NN-NN-FW

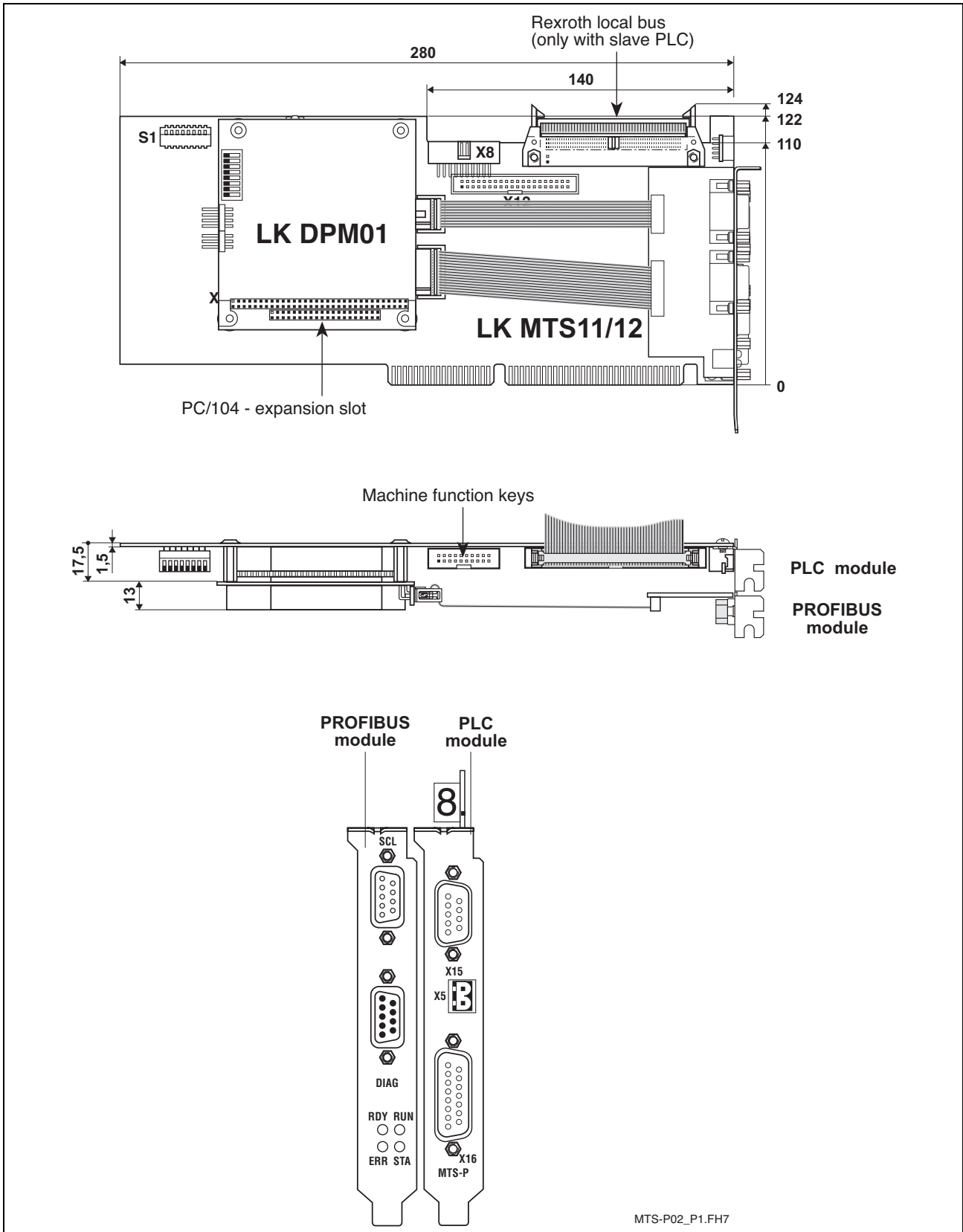


Fig. 12-3: Setup of the MTS-P0*.2-D2-P1-NN-NN-NN-FW configuration

12.4 MTS-P0*.2-D2-B1-P1-S4-NN-FW

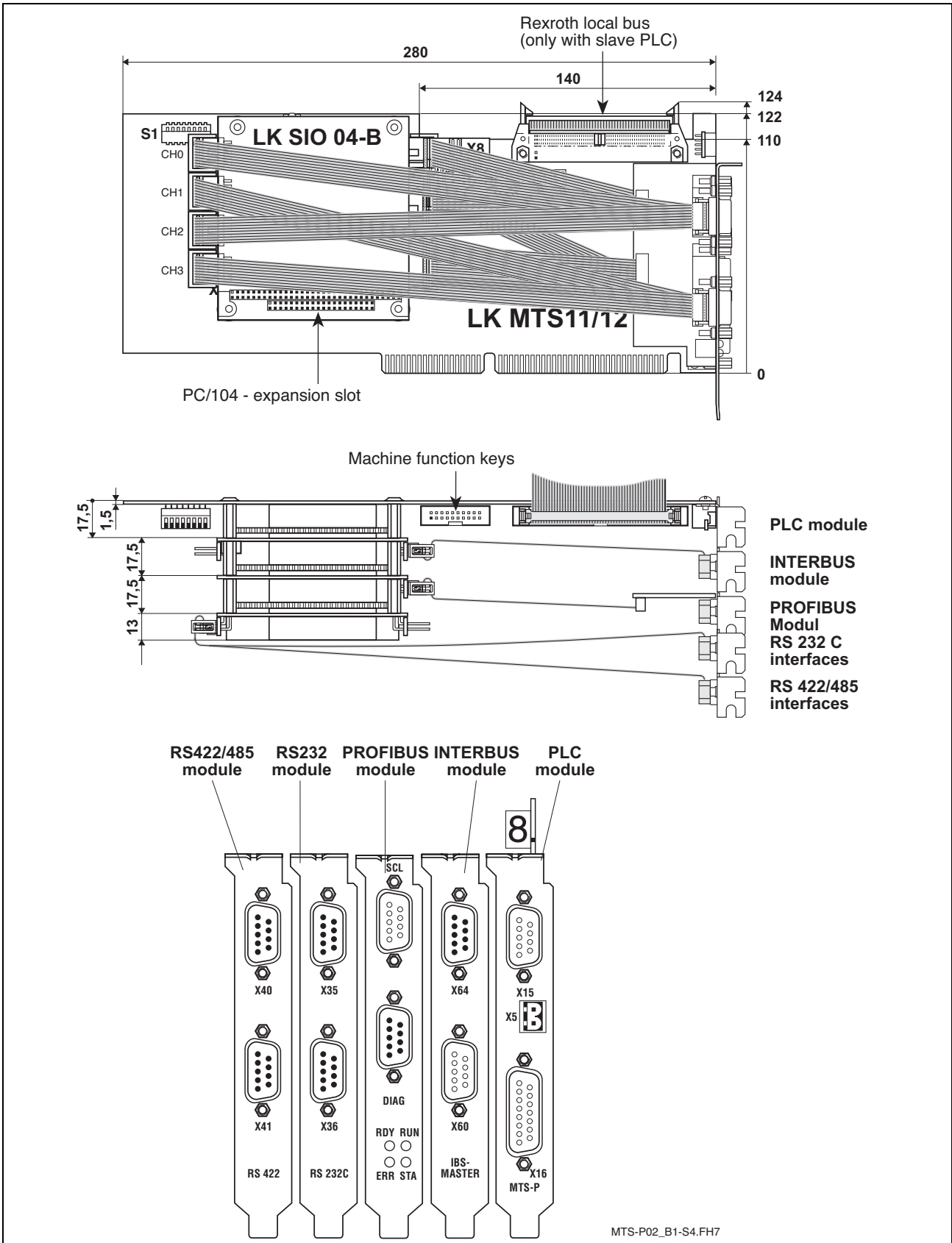
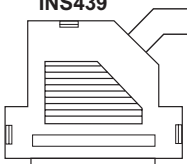
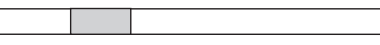
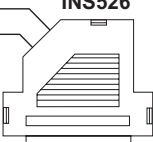
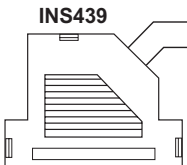

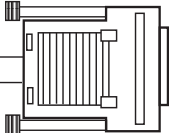
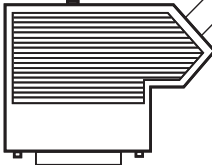

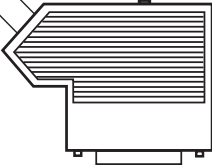
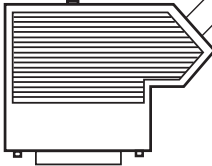
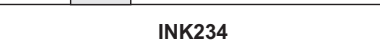
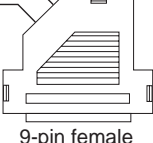
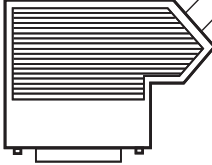

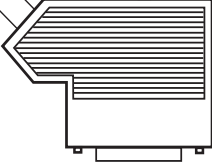
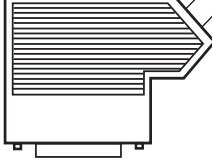

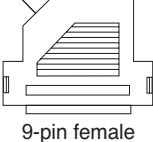


Fig. 12-4: Setup of the MTS-P0*.2-D2-B1-P1-S4-NN-FW configuration

13 Accessories

13.1 Selection List of Connectors and Ready-Made Cables

Ordering name of ready-made cables	Counter-connector on the device	Rexroth cable	Execution of cable end
<p>IKB0005 MN: 278 141, 2 m MN: 278 144, 5 m MN: 278 142, 10 m MN: 278 143, 15 m (RS232, max. 15 m)</p>	 15-pin male connector		 9-pin female connector
<p>IKB0012/000,0 MN: 281 715 (RS232, max. 15 m)</p>	 15-pin male connector		 9-pin female connector
<p>IKB0015/000,0 MN: 282 870 (RS422, max. 400 m)</p>	 15-pin male connector		 15-pin male connector
<p>IKB0016/000,0 MN: 282 871 (RS422, max. 400 m)</p>	 15-pin male connector		 9-pin female connector
<p>IKB0017/000,0 MN: 282 872 (RS485, max. 400 m)</p>	 15-pin male connector		 15-pin male connector
<p>IKB0018/000,0 MN: 282 874 (RS485, max. 400 m)</p>	 15-pin male connector		 9-pin female connector

<p>IKB0019/000,0 MN: 282 875 (RS485, max. 400 m)</p>	<p>INS619 15-pin male connector INK572 Connector sleeves</p>
<p>IKB0030/000,0 MN: 2910736 (INTERBUS configuration, max. 15 m)</p>	<p>INS0702/L01 9-pin female connector IKB0030 INK0572 IKB0030 INS0702/L01 9-pin female connector</p>
<p>IKB0031/000,0 MN: 291 805 (INTERBUS, max. 400 m) IKB0031/000,5 MN: 291 806 (INTERBUS, 0.5 m)</p>	<p>INS0703/L01 9-pin male connector IKB0031 INK0699 IKB0031 INS0702/L01 9-pin female connector</p>
<p>IKB0032/000,0 MN: 291 807 (INTERBUS, max. 400 m)</p>	<p>INS0703/L01 9-pin male connector IKB0032 INK0699 IKB0032</p>
<p>IKB0033/000,0 MN: 291 808 (PROFIBUS, max. 1000 m)</p>	<p>INS0541/K01 9-pin male connector IKB0033 INK0698 IKB0033 INS0541/K01 9-pin male connector</p>
<p>IKB0034/000,0 MN: 291 809 (PROFIBUS, max. 1000 m)</p>	<p>INS0541/K01 9-pin male connector IKB0034 INK0698 IKB0034</p>
<p>IKB0193 MN: 282041 (RS232, max. 15 m)</p>	<p>INS0525/L01 9-pin male connector INK0234 INS0526/L01 9-pin female connector</p>

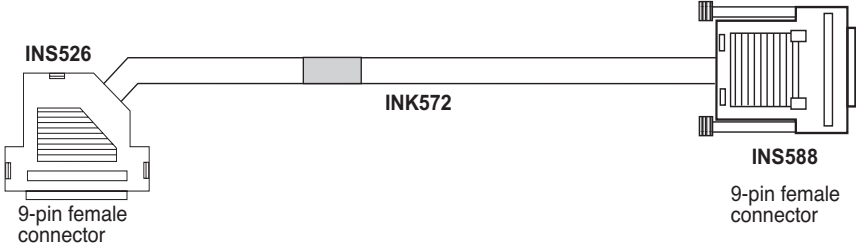
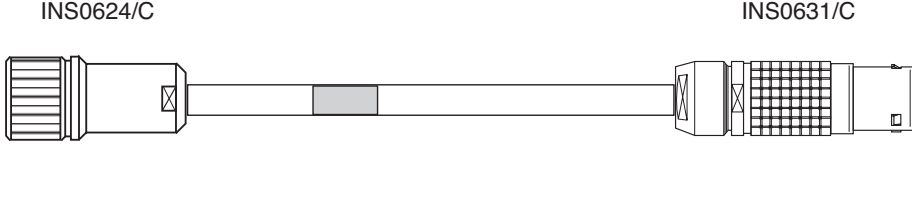
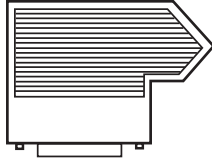
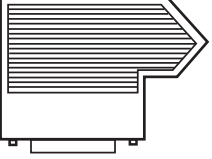
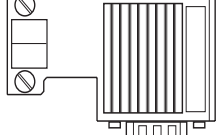
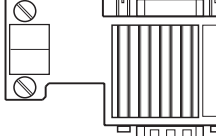
<p>IKS0106/000,0 MN: 260 838 (RS232, max. 15 m, PROFIBUS configuration)</p>	 <p>INS526 9-pin female connector</p> <p>INK572</p> <p>INS588 9-pin female connector</p>
<p>IKS0190 MN: 279 743, 3 m MN: 279 743, 5 m MN: 279 744, 10 m MN: 279 745, 15 m (RS422, max. 15 m)</p>	 <p>INS0624/C</p> <p>INS0631/C</p>
<p>INS0619/K01 MN: 279 583</p>	 <p>INS0619/RS485 (15-pin male connector)</p> <p>Y-connector for self-finishing with termination</p>
<p>INS0645/K01 MN: 282 040</p>	 <p>INS0645/RS422</p> <p>Connector for self-finishing with termination</p>
<p>INS0540/K01 MN: 279 538</p>	 <p>INS0540/PROFIBUS (male)</p> <p>PROFIBUS connector for self-finishing with termination</p>
<p>INS0541/K01 MN: 279 539</p>	 <p>INS0541/PROFIBUS (male/female connector)</p> <p>PROFIBUS connector for self-finishing with termination (attachable)</p>

Fig. 13-1: MTS-P accessories

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15 Service & Support

15.1 Helpdesk

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